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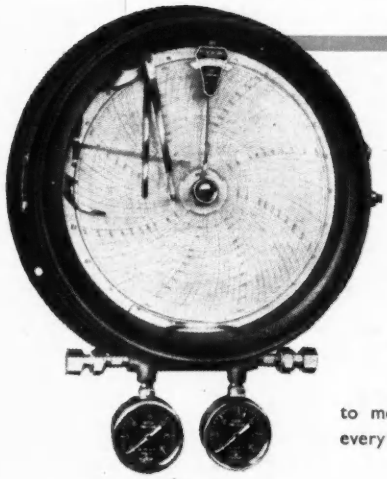

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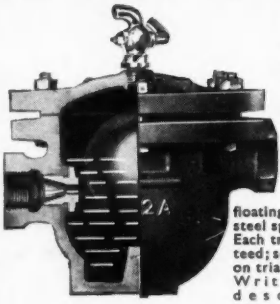

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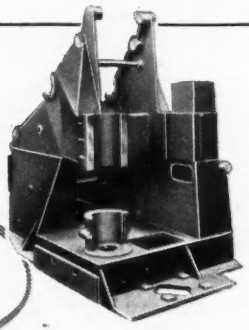

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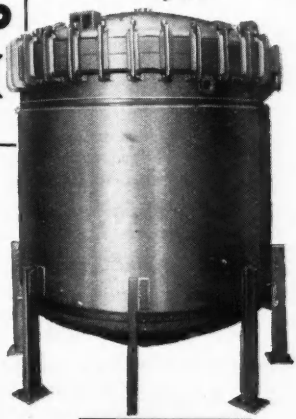

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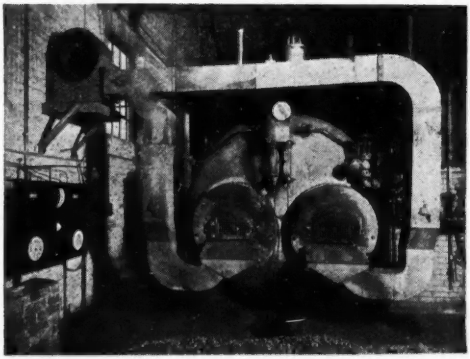

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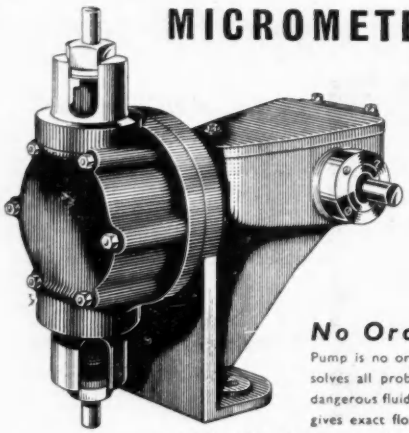

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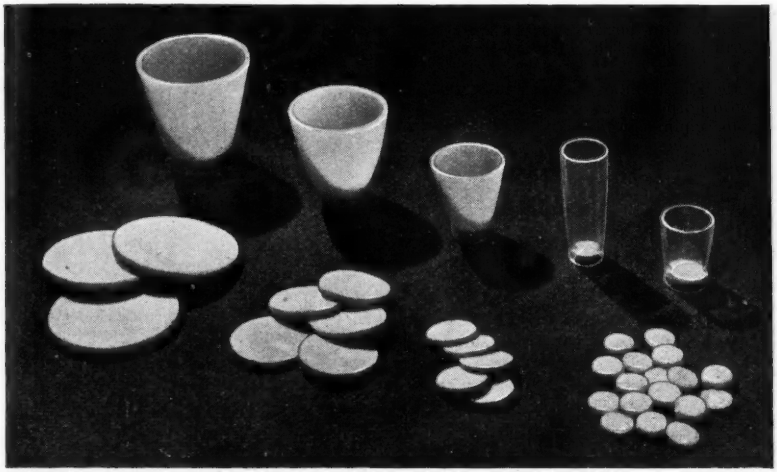

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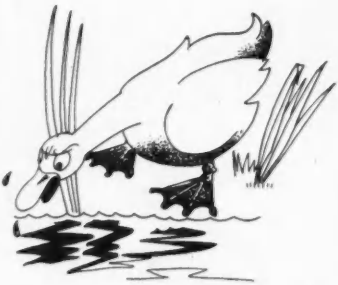

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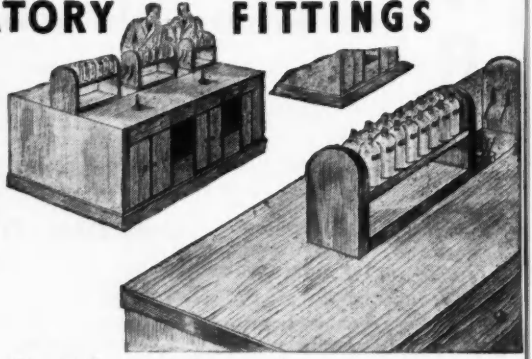

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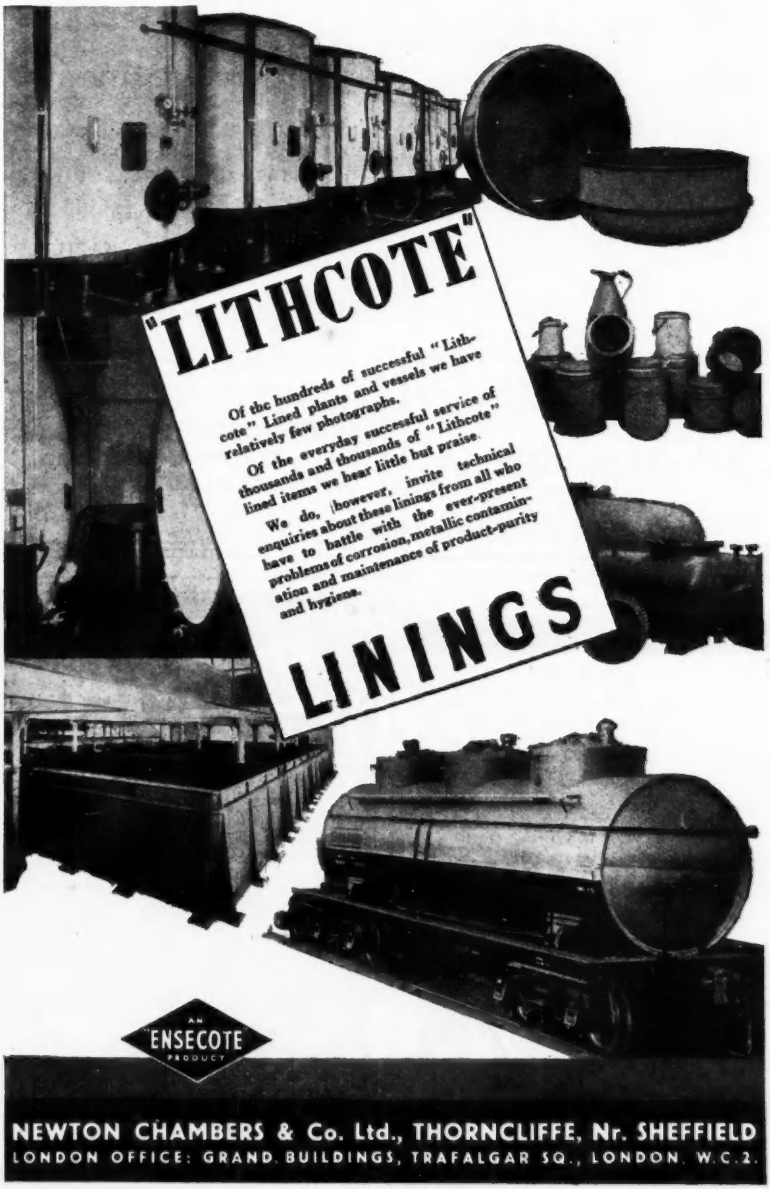
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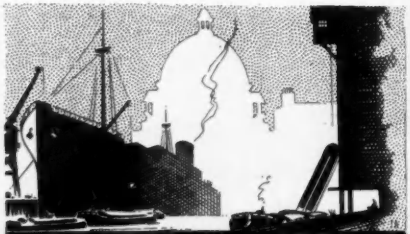

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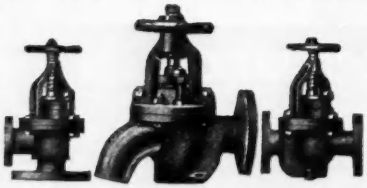
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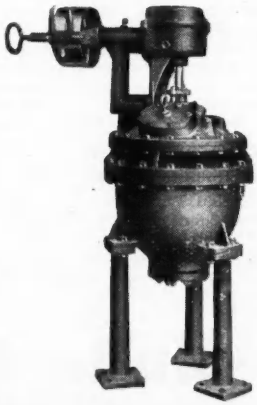

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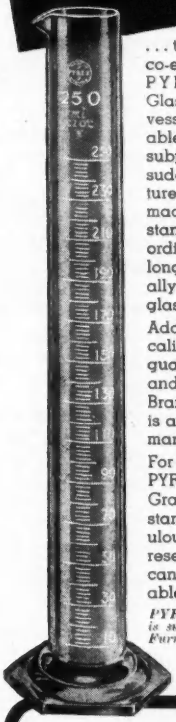

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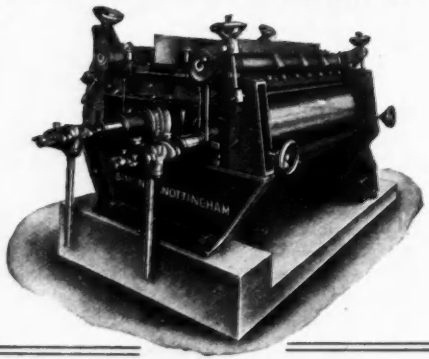

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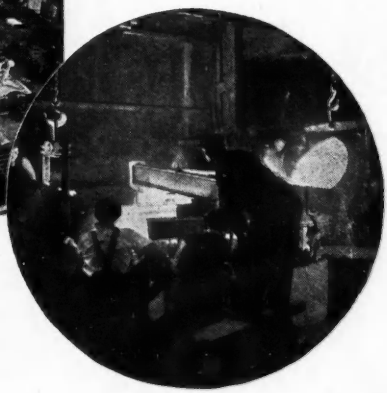

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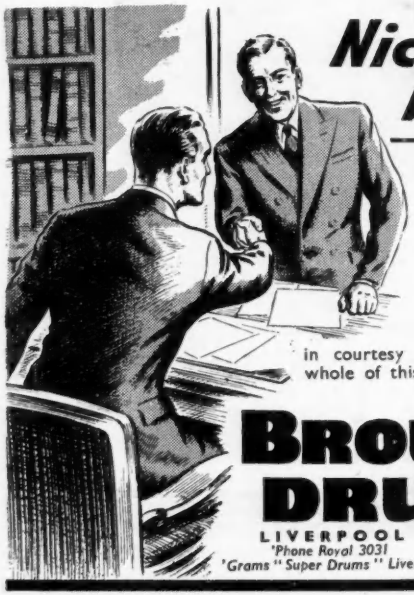

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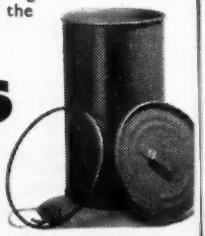

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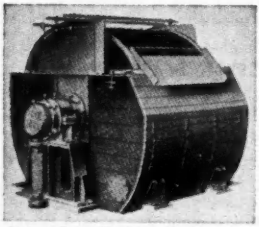

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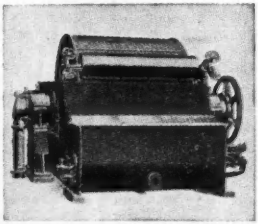

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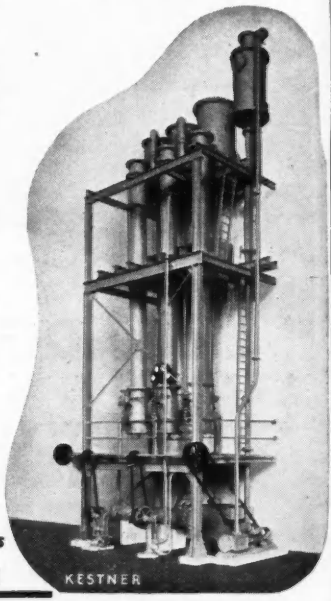

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Combined Operations

THE continual recurrence of research as the well-worn battle ground of expert debate places the subject in the category of things on which the last word is always yet to be spoken. If the reward of this perpetual parliament sometimes seems destined to be always anticlimax, in the sense that the imperative need of the moment usually proves to have remained unsatisfied when the topic reappears, crocus-like, after a lapse of 12 months or so, the passage of time detracts nothing from the vigour of debate. Total results of so much expert and sometimes impassioned advocacy on behalf of this or that method of adding to the vigour, scope and effectiveness of the country's research as a whole may seem tragically inadequate, unless it is remembered that the nature of the problem is fluid and constantly changes ground and that so long as the spirit of inquiry lives there will be revealed fresh harvests for which there are too few labourers. It is this circumstance above all others that confers grandeur upon the purpose of all who contribute to the elucidation of new ideas of chemical structure and combination or render that knowledge serviceable to human needs; they are at grips with a task whose infinity more than matches whatever inspiration it may arouse in them. If controversy and a measure of frustration seem eternally associated with the subject of research, those who take the long view will not be cast down by repeated failure to secure any degree of unanimity about what is required, much less final solutions.

Not all this disputation is in vain, even if battle often appears to have been joined in vain. If the forces applied to research problems and their administration as a whole are too formidable subjects to respond to appeals to reason and the plea of public welfare, even within the bounds of one kingdom, the campaign need not be without its victories when operations are directed against limited objectives. That is the strategy employed by more experienced campaigners such as Dr. C. H. Browning (Department of Bacteriology, Glasgow University), who is among those who have helped lately to provide a clearer picture of the background from which emerged the arresting advance in chemotherapy contributed by research chemists of I.C.I., Ltd., to relieve the scourge of *trypanosomiasis* of cattle in Africa. The exact value of that discovery has yet to be determined by prolonged and far ranging field trials, but there is little reason to doubt that here is something that will render the present armoury against the *trypanosoma* family much more effective. That it is not by any means the sole weapon was certainly not widely recognised when the first reports on Antryeide were made public. Among those who have since related the new drug to its predecessors in the campaign against the tsetse fly infection, Dr. Browning, in a letter to *The Times*, calls attention to significant parallels in the cir-

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cumstances in which both Antrycide and the earlier penanthridinum 1553 (dimidium bromide) were brought to light. Common factors of both discoveries are their mixed parentage and their intimate dependence on more than one branch of science for their development. Penanthridinium, Dr. Browning has recalled, was initially one of the series of compounds synthesised by the late Sir Gilbert Morgan and Dr. L. P. Watts and developed by Dr. Walls in the Chemical Research Laboratory, Teddington. That, he shows, was, however, much less than the whole story; without the intimate collaboration of groups of biologists both the veterinary drugs might never have emerged from the laboratory stage.

"It will be recalled," adds Dr. Browning, "that the sulphonamide drugs and penicillin also demanded similar co-operation for their fruition. These instances exemplify two points of great practical importance. The first is that the results can be achieved only by the organised collaboration of workers drawn from different fields of scientific activity. While great advances have been made, there is no doubt that for future progress in chemotherapy the additional help of bio-chemists, physical chemists, and others will be essential. Indeed, it is incontestable that the discovery of new chemotherapeutic agents is impossible except on such lines. Secondly, the recruitment and integration of the considerable forces required for these researches is at present scarcely contemplated by universities, but in view especially of the stimulating effect on those in course of training it would be a great misfortune for the progress of science if work in this field were to pass wholly to the laboratories of industrial corporations and special research institutes unconnected with teaching functions."

That conclusion characteristically points to two directions in which the present deployment of forces in one department of research falls far short of the ideal. In the ideal, the superior forces at the command of the great industrial research institutes would be matched by the resources of disinterested research. Failing that, we may be thankful that some of the big corporations at least have the power to sustain the type of "combined operations" on limited fronts, which in research—as in war—have yielded decisive results. While the universities cannot at once be similarly armed, there is no physical impediment to a much closer collaboration between universities' science departments, which collectively can muster intellectual forces equivalent to anything the industrial departments are endowed with. It is extraordinary that co-ordination of this elementary kind is still left largely to individual enterprise.

NOTES AND COMMENTS

Over £8 Million

THE continued demand around the world for United Kingdom chemicals and our increasing capacity to supply them are unmistakably presented in the Customs and Excise summary issued this week, showing that overseas sales of chemicals, drugs, dyes and colours in January realised £8,212,770, over £865,000 more than was recorded in December last and nearly £1.5 million more than in January a year ago. This individual achievement was proportionately much more arresting than the rise in the value of all exports in January to £159.2 million (£145.7 million in December), although this was £12.1 million larger than the previous highest recorded total. Scarcely any of the principal sources of chemicals in the country failed to better the export figures returned in January, 1948, and the progress reflected by some—such as the sodium carbonate group to 447,300 cwt. (January, 1948, 242,849; December, 420,472) and ammonium sulphate to 28,868 tons (against 3886 a year ago) was arresting. Caustic soda, sales of which have fluctuated very widely, and the disinfectant-weedkiller-insecticide group were among the very few chemicals showing diminished returns by comparison with 1948. (*Summary on page* 317.)

Unlucky Dip?

THE Board of Trade is again inviting "expressions of interest" by manufacturers in the U.K. in chemical plants in Germany which are about to be allocated between member nations by the Inter-Allied Reparations Agency. The knowledge that one of these represents part of the former I. G. Farben plant at Uerdingen which produced alkyd resins would seem to render this an opportunity of some importance and the character of the other, the plant of Blumberg & Co. at Lintorf for pyrotechnic manufacture, is not without interest. That interest unfortunately is very largely academic to-day, experience having shown that the element of chance which conditions this distribution of enemy war potential equates it almost with football pool competitions. It seems probable that a small part at least of the disposable German chemical plant, of which particulars have been published from time to time, has in fact reached this country. But the odds against us are somewhat around 17 to 1—18 nations were stated to be participating when the scheme began—and the Board of Trade has discouraged any unwarranted optimisism by appending a schedule of 43 German steel and chemical equipments which might have come to swell our productive capacity . . . but did not.

Dollars or Reparations

THE atmosphere of unreality which has attached to the dismantling and reparations programme from the start is being heavily underlined in the U.S.A., which would gladly put an end to it. Last week the Joint Congressional Foreign Aid Committee lent its weight to the widespread American propaganda to stop the reduction of German equipment. In a series of four reports to the Senate Foreign Relations Committee the Congressional group makes effective use of the claim that Great Britain and France are still delivering German plant as reparations to Russia, which the U.S.A. ceased to do early in 1946. The Foreign Aid Committee is now urging use of the power of ERP to preserve Germany's industrial potential, recommending that some of the money shall be used to buy out other countries' claims to such plant. While the loss to this country could probably be compensated by a comparatively modest allocation of dollars, any such solution may have the most dangerous implications in the long run. Even now undiscriminating preservation of what remains of Germany's war equipment might prove one day to have been a policy of selling security for dollars.

Vegetable Oils

A NOTE from our correspondent in Ceylon lends further weight to other evidence that the pressure on world supplies of vegetable oil and oil-bearing products is far from being relieved. The materials of chief concern in Ceylon are, of course, the coconut products and in that department the British Ministry of Food's reported offer in Colombo of 66 cents per lb. (f.o.b.) for 13 million lb. of desiccated

coconut is well below the level thought likely to prevail this year. Ceylon is under contract to supply the United Kingdom with 40,000 tons of oil and copra this year and is preparing to restrict free sales to fulfil the quota, estimates having indicated that the Island's coconut crop is likely to be reduced by nearly one-third as an after-effect of the 1948 drought. Meanwhile, the open market price of desiccated coconut, to which Colombo's Fair Price Board of millers and shippers will adhere until next week (March 5), is 84 cents per lb., 20 cents of which is statutory export duty. Pressure to place a much higher value on coconut products will be hard to resist for the duration of the lively sellers' market which since last August is reported to have sustained sales of more than 50,000 tons of "free" oil and copra at rates very much higher than we have been accustomed to pay.

Protective Glass

THE extraordinary versatility demanded by research institutions of national proportions has been made clear in more than one public statement this week, and arrestingly in a Press statement from the Department of Scientific and Industrial Research, which bears a strange resemblance to a fashion note. This says, in effect, that the well dressed (and prudent) fireman in the near future will be wearing a glass helmet. It is, however, a strictly utilitarian fashion note and the mode is very far from being as eccentric and impracticable as the bare statement suggests. This is in fact yet another indication of the widening incursion into new fields of the glass filament technique in one of its most promising forms—as a woven fabric. Much has been made of the more popular uses of this unconventional source of textiles in the domestic sphere and, while advancing technology will conceivably make these prospects more real than they are at the moment, the most obvious benefits are in industrial use, where the strength, inertness and dielectric properties of glass are of the first importance. Those are among the characteristics for which it is considered likely that glass cloth will be chosen for helmeting firemen, who are probably unique in requiring that their head covering will resist a current of at least 10,000 volts, dry or wet, and comfortably absorb the impact of something like a thunderbolt. Ajax himself might have appreciated the latest fruit of collaboration between the DSIR and the Fire Offices Committee.

SCIENTIFIC INSTRUMENTS

THE annual exhibition of the Physical Society of scientific instruments and apparatus will be held in the Physics Department of the Imperial College of Science and Technology, London, from April 5-8, 1949.

The exhibition will be open in sessions, as follows: April 5, 2-9 p.m. April 6, 10 a.m.-1 p.m., and 2 p.m.-9 p.m. April 7 and 8, 10 a.m. 1 p.m. and 2 p.m.-7 p.m..

A film on the liquid idophor or teleidoscope will be shown and the following addresses given: J. A. Ratcliffe: "Some Problems of Wave Diffraction in the Ionosphere"; A. J. Philpot: "Some Modern Aspects of Scientific Instuments"; Prof. O. R. Frisch: "A Review of the Methods and Instruments Used in Energy Measurements of Particles in Atomic Nuclei."

The craftsmanship and draughtsmanship competition is being revived after a lapse during the war, and entries will be displayed.

The competition is to encourage skill and ability among apprentices and learners in the instrument-making industry.

RUBBERS AND FIBRES

ALTHOUGH rubbers and fibres belong to different technologies, their basic chemistry is identical, it was pointed out by Dr. W. J. S. Naunton in an informal talk at Preston, Lancs., recently, on "Natural and Synthetic Polymers, with Special Reference to Rubbers and Fibres," which he gave at a joint meeting of the local members of the Royal Institute of Chemistry, the Society of Chemical Industry (including the Plastics Group), the British Association of Chemists, and the Institution of the Rubber Industry, at which Mr. H. Jackson, chairman of the Preston section of the IRI, presided.

Practically all of the synthetic fibres and rubbers could be interconverted by physical or chemical means, said Dr. Naunton. Their technology was similar. Polymerisation, mass pigmentation, extrusion and vulcanisation (in the case of rubber by chemical means in the case of fibres by physical means) were common to both fields. Their economies were similar; natural rubber and cotton remained the all-round products, whereas the synthetic rubbers and synthetic fibres found application in special uses.

CHEMICAL EXPORTS EXCEED £8 M.

An All-Round Increase

EXPORTS of the U.K. chemical industry for the first month of this year reached a new high level with a total of £8,212,770, compared with £6,756,587 in January, 1948, and £5,831,128 in 1947.

In general there has been an increase in nearly all commodities over the figures for January 1948, according to the latest issue of *The Trade and Navigation Accounts of the U.K.* (H.M.S.O. 6s. 6d.). Small declines occurred in tin oxide, zinc oxide, potassium compounds and tetra ethyl lead.

The total value of imports for January 1949 was £2,175,503, which showed a decrease of £76,584, compared with the same period last year. One of the few noteworthy exceptions to the general reduction of overseas supplies was carbon black, of which some 80,000 cwt. were received in January, against 28,000 cwt. in December and 52,000 cwt. in January 1948.

CHEMICAL EXPORTS

	Jan., 1949	Jan., 1948
Formic acid	Cwt. 3,534	Cwt. 410
Salicylic acid and salicylates	Lb. 177,772	Lb. 162,590
Value of all other sorts of acid	£92,458	£73,686
Aluminium oxide	Tons 48	Tons 21
Sulphate of alumina	3,902	3,106
All other sorts of aluminium compounds	250	313
Ammonium sulphate	28,868	3,886
Ammonium nitrate	8,150	10,290
All other sorts of ammonium compounds	1,366	870
Bleaching powder	Cwt. 61,902	Cwt. 30,510
All other bleaching materials	7,191	7,684
Cresylic acid	Gal. 115,819	Gal. 186,939
Tar oil, creosote oil, anthracene oil, etc.	4,938,489	6,246,099
Value of all other sorts of tar oil	£54,139	£24,642
Collodion cotton	Cwt. 2,811	Cwt. 769
Copper sulphate	Tons 1,469	Tons 233
Disinfectants; insecticides, etc.	Cwt. 34,411	Cwt. 58,238
Fertilisers	Tons 5,626	Tons 3,335
Nickel salts	Cwt. 6,576	Cwt. 5,694
Lead acetate, litharge, red lead, etc.	10,433	5,048
Tetra-ethyl lead	Gal. 99,001	Gal. 162,863
Magnesium compounds	Tons 791	Tons 756
Methyl alcohol	Gal. 16,553	Gal. 4,549
Potassium compounds	Cwt. 7,579	Cwt. 13,122
Salt	Tons 14,844	Tons 11,691
Sodium carbonate, etc.	Cwt. 447,300	Cwt. 242,849
Caustic soda	140,695	186,412
Sodium silicate	36,230	8,354
Sodium sulphate	43,795	46,802
All other sodium compounds	81,004	78,484
Cream of tartar	458	378
Tin oxide	362	876
Zinc oxide	Tons 819	Tons 1,049
Total value of chemical manufactures, excluding drugs and dyestuffs	£4,280,789	£3,369,281
Quinine and quinine salts	Oz. 290,514	Oz. 114,846
Acetyl-salicylic acid	Lb. 223,031	Lb. 41,482
Insulin	100 International units 1,470,544	100 International units 705,825
Penicillin	Mega units 362,955	Mega units 214,001
Total value of drugs, medicines, and preparations	£1,594,471	£1,532,029
Plastic materials	36,726	32,742
Value	£497,384	£367,088
Chemical glassware	Cwt. 1,691	Cwt. 1,445
Value	£54,831	£46,189
Coal	Tons 973,275	Tons 287,711
Value	£3,620,883	£958,262
Fans	Cwt. 5,752	Tons 192
Value	£154,216	£97,268
Furnace plant	Cwt. 7,676	Tons 434
Value	£86,120	£89,642
Gas and chemical machinery	3,125	Tons 144
Value	£48,716	£42,421

CHEMICAL IMPORTS

	Jan., 1949	Jan., 1948
Acetic acid	Cwt. —	Cwt. 13,724
Boric acid	900	12,500
All other acids	3,249	1,541
Borax	Cwt. 6,056	Cwt. 36,700
Calcium carbide	38,009	—
Coal tar products, excluding benzol and cresylic acid	8,168	15,512
Cobalt oxides	402	911
Arsenic	Tons 100	Tons 753
Fertilisers	9,721	1,032
Iodine	Lb. 66,050	Lb. —
Potassium chloride	Cwt. 280,635	Cwt. 566,805
Potassium sulphate	29,560	49,812
All other potassium compounds	13,358	6,912
Sodium nitrate	87,736	—
All other sodium compounds	4,322	4,011
Carbon black	80,829	53,389
Total value of chemicals, drugs, dyes and others	£2,175,503	£2,252,087

Big Saving Effected in Water Purification

Use of Subsidiary Chemicals Rendered Unnecessary

AN annual saving in chemicals of a value of at least £10,000, and possibly very much more, is foreseen in a report of the water examination committee of the Metropolitan Water Board, which the board adopted at its meeting on February 18. The report describes a new method of super-chlorination which has led to reduction of the bacterial content of the water supplied to the London area, in a reduction of colour by 23 per cent, and in a complete cessation of complaints of chlorinous tastes by consumers.

It refers to the scientific interest and great practical importance of the experiments in super-chlorination carried out by the director of water examination, Lt.-Col. E. F. W. Mackenzie, not only to the board, but also probably to other bodies charged with supplying water to large populations.

The full effect of the new method upon consumption of chemicals for water treatment has been felt only since January 1, when all pre-chlorination in the Thames valley was stopped. The savings shown in the following table have, therefore, been calculated over a relatively short period.

AVERAGE WEEKLY COST OF CHEMICALS AT FILTRATION WORKS

	July-Dec., 1947	January, 1949	Weekly saving
	£	£	£
Chlorine	363	221	142
Sulphur dioxide	47	Nil	47
Ammonia gas	121	Nil	121
Ammonium sulphate ...	34	Nil	34
Totals ...	£565	£221	£344

This constitutes a saving, on chemicals such as sulphur dioxide, ammonia gas, and ammonium sulphate, at the rate of £17,888 per annum. Circumstances will arise at times, states the report, which will necessitate an increase in the present rate of consumption of chemicals; at other times there may be a reduction, but on the whole the period under comparison has, if anything, favoured a low consumption.

So successful has super-chlorination proved that the belief that pre-chlorination of the water could be discontinued without any deterioration in the quality of the finished water was justified, the report states. The following experiment was, therefore, devised. Pre-chlorination was stopped at a works where the quality of the filtered water is particularly dependent upon this process. As a result the filtered water became extremely bad, containing, on one occasion, 90 *bact. coli* per 100 ml., yet the water pumped into supply after treatment by super-chlorination has been of good physical quality and the bacterial purity has been 100 per cent. It is thought unlikely that filtered water of worse bacterial quality will be encountered at any of the board's works.

Extreme cold retards the action of chlorine and it may be that results will not be so good when such conditions prevail, but the completion of contact tanks already in course of construction at several of the board's works will enable these difficulties to be surmounted, as also the difficulties experienced when the natural ammonia in the water increases.

In the light of the experiment outlined above, it was felt that the expenditure of large quantities of chlorine on pre-chlorination could hardly be justified at times when the natural ammonia in the filtered water was sufficiently low to enable super-chlorination to be used for terminal sterilisation.

Profitable Recovery of Methane

Mr. F. W. Toon, manager of Beddington Irrigation Farm, owned by Croydon Corporation, claims that Croydon is the leading local authority in developing the use of methane as a substitute for petrol. The present daily gas production on the farm is approximately 250,000 cu. ft., equivalent to the use of six tons of coal and 1250 gallons of petrol. A fleet of heavy vehicles is run on this methane. Crude gas extracted from sewage also runs the farm's electricity generating station, saving an annual bill of roughly £8000.

Oil Prices Reduced

Reduction in the prices of gas and diesel oil supplied by Shell Mex & B.P., Ltd., came into effect from February 9. A cut of ¼d. per gall. (10s. a ton) was announced in the prices of Shell gas oil (for diesel engines and other industrial purposes), B.P. gasoleum (for small marine craft), and Shell domestic fuel oil used in domestic heating.

The Anglo-American Oil Company announced a reduction of ¼d. per gall. in Esso gas and diesel oils, to apply only to their inland schedule. The grades concerned were: Esso gas oil, heating oil, diesel medium, and marine diesel medium.

Diesel oil (Derv) used for road vehicles, is also reduced ¼d. per gall. by both companies.

GERMAN EXPORT CHEMICALS

Slow Progress Recorded in 1948

THE foreign trade statistics of the Anglo-U.S. occupation zone of Germany for 1948 show substantial increases in imports above pre-war figures, while chemical exports remained only a fraction of pre-war quantities.

Bizonal imports of chemicals (excluding plastics, dyes, paints, lacquers, glue, explosives, etc.) amounted to 187,900 tons in 1948 against 53,270 tons for the whole of Germany in 1936. Imports of phosphatic fertilisers amounted to 436,880 tons (504,970 tons in 1936), and of nitrogenous fertilisers to 87,240 tons (92,050 tons).

Bizonal exports in 1948 included 1850 tons of dyestuffs (33,740 tons for the whole of Germany in 1936), 22,130 tons of paints, lacquers and varnishes (75,270 tons), 36,070 tons of industrial chemicals (734,320 tons), and 570 tons of pharmaceutical products (7240 tons).

Monthly import and export returns for the last few months of 1948 show that both imports and exports of chemical and allied products towards the end of the year were proceeding at a rate considerably above the 1948 average, and the increase is reported to have continued in the first two months of the current year.

Plans are afoot to produce columbium, of commercial interest chiefly as an ingredient in austenitic stainless steel, in South Baden. The metal occurs in calcareous rocks in the Kaiserstuhl mountain in the form of dysanalyte and koppite.

A lime kiln is being built at present at Scheler Matten where the limestone is to be burnt, thus reducing its weight by half. It has not yet been decided whether the further treatment of the mineral is to be done by a German enterprise, in which the State of South Baden would have a controlling interest, or by a joint French-German undertaking.

Soviet Zone

The Leuna plant in Saxony-Anhalt has resumed the production of synthetic motor spirit, it was recently announced officially; there are now about 21,500 workers employed at Leuna, and chemical fertilisers are still the most important product of this, probably still the largest chemical plant in the Soviet zone of Germany.

Of other *ex*-I.G. Farbenindustrie works in eastern Germany the Agfa factory at Wolfen is credited with the manufacture of 90 different kinds of photographic and cinematographic film, including colour film. The production of perlon has been increased in the works of late, and artificial fibres are being made on a large scale at Wolfen.

Russian Plans

The following "target" figures have been set for the production of important chemicals in the Soviet zone of Germany (the basis is 1946 = 100, and the 1948 figures given for comparison seem to be provisional estimates of actual output):

	1948	1949
Sulphuric acid	148	187
Soda ash	164	185
Carbon bisulphide	117	164
Calcium carbide	174	230
Potash salts	118	122
Caustic soda	155	157
Sodium chloride	163	189

The shortage of sulphuric acid and soda ash has lately been particularly acute. Lack of sulphuric acid, said to be due to the bad state of repair of existing plant, prevented superphosphates factories during the autumn and winter from making full use of the imported rock phosphates available. In future part of the supply of crude phosphates is to be treated with nitric acid which seems to be more plentiful.

The production target for paints and lacquers in the second half of 1948 is said to have been reached, but a number of urgently needed paint products were, in fact, not produced in sufficient quantities because of lack of organic raw materials. The pharmaceutical industry failed to meet its output target in the second half of 1948 and is to pay more attention to the synthetic manufacture of pharmaceutical raw materials.

Shortage of raw materials is also held responsible for the disappointing course of soap manufacture in the Soviet zone. Among chemical raw materials, potash salts alone are available in adequate quantities, and the potash industry has therefore not been instructed to raise its production substantially.

An illustration of the technical difficulties facing chemical works in eastern Germany is provided by an appeal sent out by the Schwarza rayon factory to "activists" in other Soviet zone factories. The management at Schwarza states that operations are being held up by lack of about 4000 metres of pipes of various kinds, flanges, hoses, etc., which it has been impossible to secure from any source in the Soviet zone.

New National Formulary

Basis of the 1949 Edition

A NEW National Formulary* was published this month and for National Health Service purposes will come into operation on May 1, 1949.

An informative address on the work of the experts responsible for its production was given last week at the Pharmaceutical Society, London, by T. C. Denston, a joint secretary of the Joint Formulary Committee representing the British Medical Association and members of the committee on the national pharmaceutical service.

In 1941 the National War Formulary came into being, and the new National Formulary is largely to replace the previous edition which, although amended up to 1947, still bears the word " War " in parenthesis, and is now inadequate in the formulæ which it contains.

The committee, under the chairmanship of A. E. Barnes (BMA), aimed at producing a volume of convenient size which may be carried in the pocket of the practitioner and pharmacist. The broad approach of the new Formulary renders it clearly of general use not only to those concerned with the National Health Service, but also to the private practitioner, the hospital, health centre or convalescent home.

A provisional list of preparations was submitted to a large number of bodies representing medical and pharmaceutical practice.

In some cases lack of independent standards of the ingredients made it impossible to accept formulæ, while in others slight variations from established formulæ were excluded to avoid duplication of preparation having the same therapeutic value.

There were two instances in which the committee, on grounds of policy, declined to make additions. These were requests for the inclusion of preparations containing diamorphine (heroin), and mixtures and powders containing bismuth carbonate, such as have appeared in earlier formularies. In the case of diamorphine, the committee decided that the caution needed when prescribing it should restrict its use to the essential cases where dosage can be considered in relation to the individual patient.

Bismuth carbonate, it was considered, had no advantage over analogous preparations used in recent years and there was therefore no reason why it should replace them.

* "The National Formulary 1949". The Pharmaceutical Press, 17, Bloomsbury Square, London, W.C.1, Price 2s. 6d. post paid.

Dollars for U.K. Subsidiary

ECA Aid for U.S.–Scottish Instruments

AS part of ECA's investment guaranty programme designed to encourage American industry to invest dollars in projects that will promote European recovery, a $300,000 guarantee has been signed with the Minneapolis-Honeywell Regulator Company, of Minneapolis, Minnesota, the Economic Co-operation Administration announced last week. The contract guarantees the transfer of pounds sterling into dollars and is limited to the dollar investment Minneapolis-Honeywell is making in the United Kingdom. The guarantee does not cover the conversion of profits.

Minneapolis - Honeywell will invest $300,000 in its wholly-owned subsidiary, Honeywell-Brown, Ltd., which since 1938 has sold the parent company's products in the British market. The latter company has a plant near Glasgow in which it will fabricate most of the parts needed in Minneapolis-Honeywell indicating, recording and controlling instruments used in steel, chemical, oil refining, textile, paper, metal working and other industries.

ECA pointed out that the investment will help to advance the modernisation of British manufacturing methods and also increase United Kingdom industrial instruments for export. Honeywell-Brown, Ltd., anticipating the ECA sanction, has gone ahead with its programme and expects in the near future to have its first British-assembled instruments available for delivery.

ANGLO-AMERICAN PLASTICS

A LICENSING agreement has been completed between Ashdowns, Ltd., Eccleston, St. Helens, England, and the Panelyte division of the St. Regis Paper Company, one of America's largest producers of laminated plastics in industrial and decorative fields, for the manufacture and sale of Panelyte abroad. A similar agreement has been concluded with the Swedish firm of Skanska Attikfabriken. The agreement provides Ashdowns, Ltd., with production and sale rights of Panelyte in the British Isles (Eire excluded), and the Skanska company in Sweden, Finland, Norway, and Denmark. Patents, machinery designs and formulæ used in the production of plastics, and Panelyte technology will also be made available.

Fewer Factory Accidents.—In spite of the fact that more people are exposed to the risk of accident through greater use of machinery, factory accidents in Birmingham were lower in 1948 than ever before.

IMPROVED SOLVENT EXTRACTION

Means of Relieving Vegetable Oil Shortage

MANY years of specialised research have been given to the designing of plants for solvent extraction, most of it directed to recovering the maximum amount of extract with the minimum consumption of heat, power, solvent and labour.

The present considerable demand for vegetable oil recovery has focused further attention on improved extraction plants, among them the Merz extraction process, which has been very highly developed. The technical and production resources of the London Aluminium Co., Ltd., are now being applied to the construction and development of Merz solvent extraction and edible oil refining plants.

In the majority of extraction plants the extractor and still are separate units; in the Merz design they are in one vessel, separated by an internal head. The advantage of this lies in the utilisation of the heat of the solvent vapours emanating from the still for the purpose of warming the material in the extractor.

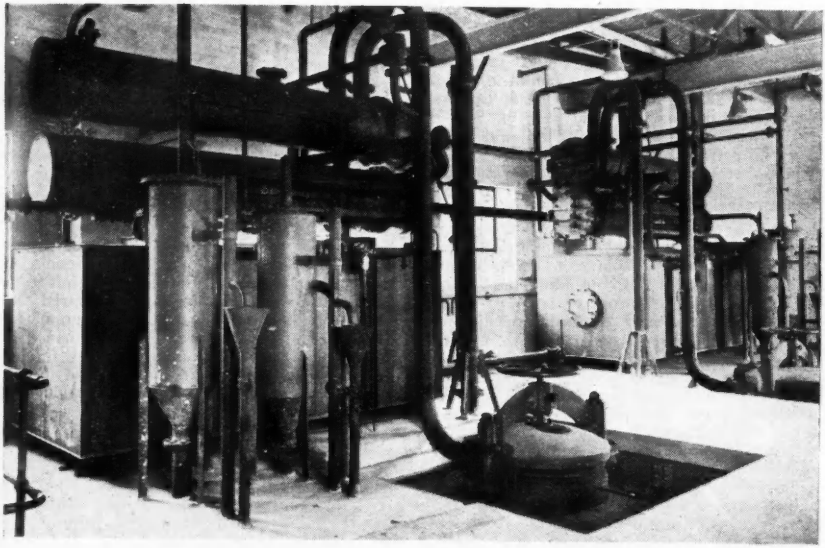
By means of special cocks connecting the still with the extractor it is possible to force the solvent vapours through the material to be extracted, thus not only achieving a temperature in the extractor nearly as high as the boiling point of the solvent, but also removing any excessive moisture contained in the raw material.

During the warming up of the extractor solvent vapours are condensed within the raw material and the concentrated solutions formed drop back into the still.

An important feature of the condenser design is the achievement of quick extraction by the condensed solvent being returned hot into the extractor without losses.

A point of interest is that the extractor is fed with solvent by gravity, no pumps being required. Once the valves are set, the process is nearly fully automatic and needs little supervision.

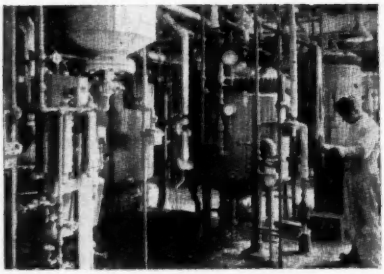
For finely ground and pulverised materials straightforward extraction has to be replaced by a decanting process. The plant for this purpose consists of a decanter extractor, filter, pump, still, condenser, automatic separator, solvent tank and dust catcher.



Condenser sections of two solvent extraction plants by Merz Patents, Ltd., Burton-on-Trent, each consisting of an upper multi-pass shell and tube condenser, and underneath, a multi-pass shell and tube after-cooler

ORGANOSILICON CHEMISTRY

Basis of New Materials



Part of a battery of glass-lined kettles in which silicone fluids are produced in the Dow Corning plant in Michigan

AN authoritative review of the sources and characteristics of silicones and of the progress which has been made in recent years in producing silicone materials of direct industrial use was given at the meeting in London last week of the London section of the Oil and Colour Chemists' Association by Dr. D. V. N. Hardy, B.Sc., Ph.D., F.R.I.C., formerly principal scientific officer of the Chemical Research Laboratory (DSIR), Teddington. Mr. David E. Roe (chairman of the section) presided.

Advent in Industry

Dr. Hardy took stock of the present position in regard to silicones and indicated some results obtained by a small research group at the Chemical Research Laboratory, Teddington.

It was not quite six years, he said, since the industrial advent of silicones in the United States. During that time the new materials had been given wide publicity, and it had been claimed that their unique combination of properties made them suitable for a great variety of industrial applications. Doubtless some of those claims had been exaggerated, but underlying them all was a sound stratum of truth.

The production and processing of silicones had frequently been described in general terms, but the details had not been revealed. While a growing series of patents covered commercial development and the scientific aspects had been described in a large number of journals, there remained many gaps in our knowledge of these new synthetic products.

The study of organosilicon compounds, he said, which had commenced in 1863 with the preparation of tetraethylsilane by Friedel and Crafts, was a field of purely academic interest until the years immediately prior to the recent war. The latter half of the academic period of study was distinguished by the many contributions of Frederick Stanley Kipping, Professor of Chemistry at University College, Nottingham.

Great experimental difficulties were encountered, particularly the ease with which organosilicon compounds passed into intractable gummy and glassy products, but they had proved no deterrent to Kipping; rather had they impelled him to devote his active life to the academic study of organosilicon chemistry.

The possibility that the results might have an industrial bearing did not appear to have been seriously entertained; but the march of contemporary events, particularly in the field of high polymers, was already causing a few advanced thinkers to speculate concerning the gums and glasses that had made Kipping's work so difficult.

The development of colourless transparent polymers into organic glasses would suggest that organosilicon resins would have properties intermediate between the inorganic and the organic glasses, and that their dielectric properties might be superior to those of the many other resins which were finding application in the electrical industries.

Might it be possible to produce complex organosilicon compounds which would parallel the range and valuable properties of the mineral silicates, and yet have the merit of greater tractability, particularly with regard to fusibility and solubility?

Why "Silicones"?

On the question of nomenclature, Dr. Hardy said the word "silicone" was originally coined by Kipping to denote the silicon analogues of the ketones (RR'Si : O c.f. RR'C : O), but it had transpired that such silicones could not exist in monomeric form. The term, therefore, was misleading since it suggested an analogy which did not exist, and it was no longer used in the original sense. It is now employed somewhat loosely to cover, not only all compounds which contain two or more silicon atoms linked by oxygen atoms, but also all materials prepared therefrom.

A systematic nomenclature has been proposed for organosilicon compounds, based on the following rules:—

1. Organosilicon compounds of general formula $R[R_2Si]_n.SiR_3$, where R may be an organic radical, hydrogen, halogen or an alkoxy- or aryloxy-group, and n = 0, 1, 2, 3....., are named as *silane* derivatives.

2. Organosilicon compounds containing the group Si-O-Si are named *siloxane* derivatives.

3. Cyclic organosilicon compounds of the general formula $[_2SiO]_n$ are cyclo-*siloxanes*.

4. Organosilicon compounds containing one or more hydroxy groups attached to silicon are named by adding the suffixes -ol, -diol, -triol, etc.

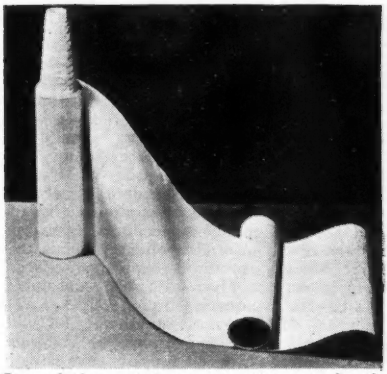
The following examples were given to illustrate the application of those principles :—

Formula of Compound.	Systematic Name.
$SiMe_3Et$	Trimethylethylsilane.
$SiMe_2Cl_2$	Dimethyldichlorosilane.
$SiEt_3OH$	Triethylsilanol.
$SiPh_2(OH)_2$	Diphenylsilanediol.
$SiEt_3.O.SiEt_3$ ...	Hexaethyldisiloxane. *M*
$SiPh_3.OEt$	Triphenylethoxysilane.
$SiPh_2(OH).O.SiPh_2OH$	Tetraphenyldisiloxane-1 : 3-diol.
$(SiEt_2O)_3$	Hexaethylcyclotrisiloxane.

Discussing the preparation of organosilicon compounds, Dr. Hardy said it would be apparent that the essential step consisted in attaching the hydrocarbon radical to the silicon atom. This had usually been achieved by treating silicon halides with organometallic compounds, such as zinc alkyls, mercury diaryls and Grignard reagents, or with sodium and an alkyl or aryl halide. Sometimes alkyl silicates might be employed in place of silicon halides.

Grignard reagents, he said, could be prepared in great variety and with relative ease; moreover, the technique was simple and convenient. There could be little doubt that for all round purposes the Grignard synthesis was by far the best method based on the use of organometallic compounds.

All those methods were capable of yielding compounds with from one to four organo groups attached to the silicon atom, and in general all the possible compounds would be formed. Their relative amounts might to some extent be controlled by proportioning the reagents, and for that purpose the Grignard method was again to be preferred, but it would normally be necessary to separate the products. That separation sometimes proved difficult.



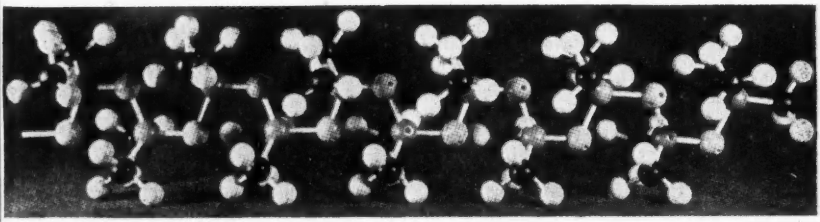
One of the most recent attempts in the U.S.A. to find wider uses for organosilicon material is represented by this silicone-coated glass cloth, offering exceptional heat and electrical resistance

The search for improved methods of synthesis had attracted much attention, and some success had been attained. Dr. Hardy discussed some of the work that had been done and gave specific examples of the production of various compounds and the separation of intermediates, illustrating some of the apparatus used.

Three Groups

Coming to the hydrolysis of pure organosilicon intermediates, he said that three classes of those intermediates were possible, depending on the presence of one, two or three hydrolysable groups. According to the number of hydrolysable groups present in the intermediate it was called mono-, bi- or tri-functional. Silicon tetrachloride and the alkyl ortho silicates might be considered as tetrafunctional, although by definition they were not truly organosilicone compounds :—

Intermediate ...	R_3SiX	R_2SiX_2	$RSiX_3$	SiX_4
Functionality ...	1	2	3	4



Representing a segment of the linear methyl silicone molecule (*Smithsonian Report*, 1947)

According to their functionality, those intermediates differed in their behaviour on hydrolysis.

Monofunctional derivatives hydrolysed to the corresponding silanols, which were in turn readily transformed into disiloxanes.

Bifunctional intermediates hydrolysed initially to the corresponding silanediols, many of which had transient existence, and passed easily or spontaneously into linear and cyclic polymers of considerable variety.

The trifunctional intermediates hydrolysed to give complex products, perhaps initially of linear and cyclic type, but the initial soluble products quickly suffered dehydration to give infusible, insoluble cross-linked structures.

Dealing with the tetrafunctional, he said that silicon ester hydrolysed to complex silicon esters which eventually gave silicic acid.

Functional Control

The various organosilicon intermediates were the bricks from which the commercial silicones were prepared. The tri- and tetrafunctional intermediates had a restricted utility of their own, but by judicious admixture with bifunctional intermediates one might obtain products with controlled amounts of cross linkage and hence with novel properties.

Similarly the monofunctional intermediates might be used to control the chain length and to modify the properties of silicones derived from other intermediates. That was of fundamental importance in the production of industrially useful silicone products.

It would be apparent, he said, that further modifications would be possible by ringing the changes on the organo groups present. At present, most of the commercial silicone products were derived from methyl substituted intermediates, notable exceptions being found among the silicone resins.

Hexamethyldisiloxane is a colourless mobile liquid which boils at 99.5° and is commercially available as "DC200 (0.65 cstks.)." It is a valuable intermediate of monofunctional type, and in the presence of strong acids, notably sulphuric, it will react with many other silicone fluids as trimethylsilyl salts. Its main function is to control the chain length of a polymer by blocking the free hydroxyl groups—it is in effect a chain stopper.

Discussing the polymers of dimethylsiloxane, the speaker said that any of them, whether of cyclic or of linear type, will react with hexamethyldisiloxane simply by shaking in the cold for 16 hours with a small proportion of concentrated sulphuric acid.

The siloxane linkages are loosened and re-combination occurs to give an interesting and valuable series of water-white fluids of linear structure, with trimethylsilyl groups at the ends of the chains. The chain length may be controlled by varying the proportion of hexamethyldisiloxane.

Dealing with the properties of the chain-stoppered dimethylsiloxane polymers, Dr Hardy said the simpler members of the series have low melting points, and it is possible to combine in one liquid low melting point and low volatility. The series covers a very wide range of viscosity, and the viscosity of each individual is much less affected by temperature than is the case for most other liquids. He illustrated the viscosity-temperature gradients of several of those so-called "silicone fluids" compared with those of two hydrocarbon oils, one a hydraulic oil and the other a transformer oil. The difference was most marked. Those fluids, he said, are also remarkably stable at high temperatures and are little affected by air or oxygen at temperatures up to 200°. Their dielectric properties are excellent.

The fluids are finding many applications in industry, *e.g.*, as special lubricants, hydraulic media, shock absorbers, high temperature baths and diffusion pump oils. Probably their largest sales are for use as mould-release agents, particularly for rubber articles, and for breaking emulsions. Some types of emulsion are broken with extremely small concentrations o silicone fluid, *e.g.*, 1 in 10^6.

Resins

Of the resins, he said that mixtures of by- and tri-functional methylsilane intermediates can be converted into soluble resins by careful hydrolysis and controlled condensation. It is necessary to use mixtures which have a ratio of methyl groups to silicone atoms from 1.2 to 1.5.

The resins are soluble in benzene and may be applied in thin coatings by brushing or dipping. When heated to moderate temperatures they become insoluble, but he had not found the products to be highly resistant to heat. After 24 hours at 150° they were invariably crazed and extremely brittle.

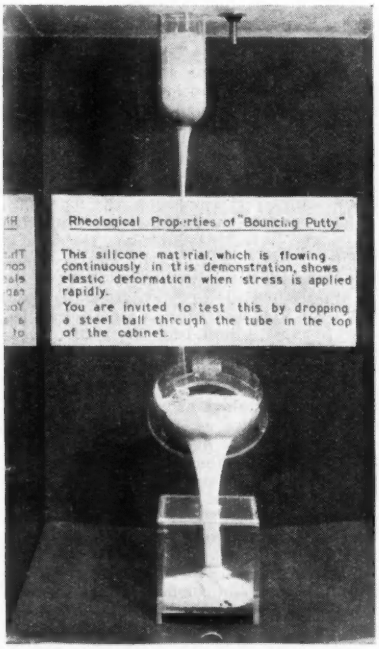
Resins of highly improved performance have been produced from mixtures of hexamethyldisiloxane and methyltriethoxysilane having from 1.2 to 1.5 methyl groups per silicon atom. These require heating at temperatures above 200° to convert them into insoluble coatings, and they can be heated at 200° for long periods without crazing or becoming brittle. At 200° they show a slight tendency to soften and flow. Such resins are transparent and slightly yellow. They can be mixed with thermally

stable pigments to make attractive heat-resisting paints.

The dielectric properties of some of the methylsilicone resins prepared at Teddington have been determined by the Electricity Division of the National Physical Laboratory. Giving details of those properties, Dr. Hardy said there was a somewhat wide variation in the dielectric properties, attributable in part to the practical difficulty of producing ideal specimens, but despite that, some of the results were very promising.

Commercial Resins

The commercially available silicone resins are not based on methylsilicones; they are usually derived from silicones containing ethyl and phenyl groups. On account of their heat resistance and good dielectric properties they are suitable for the production of a new range of electrical insulations capable of withstanding temperatures considerably higher than the accepted limits for conventional insulations based on organic drying oils and resins.


Rheological Properties of "Bouncing Putty"
This silicone material, which is flowing continuously in this demonstration, shows elastic deformation when stress is applied rapidly.
You are invited to test this by dropping a steel ball through the tube in the top of the cabinet.

The elasticity of "silicone putty" has been arrestingly revealed by the British Thomson-Houston Co. Ltd. in this exhibition piece

The new resins may be used to coat wires, or may be applied to glass fabric to produce flexible sheets. Several layers of the resin-impregnated glass fabric can be bonded together to give rigid laminates in different thicknesses, which may be cut to the size and shape required or may be used as panel boards.

Silicone resins are available for use in formulating protective coatings having high resistance to heat, moisture, oxidation and ultra-violet rays. Tests indicate that no paint vehicles yet developed have as great a capacity for resisting long exposure to weathering as these have. They can withstand continuous exposure to 250°C. and are, therefore, used for coating ovens, smoke-stacks, boilers and silencers.

A rapidly expanding use is in the bakery, where one form is being used to coat the bread tins, eliminating the use of grease and lasting for many bakings.

Stable Greases

Dealing with the silicone greases, Dr. Hardy said that hydrolysates of mixtures of bi- and tri-functional methylsilane intermediates can be readily converted to gels, and when these are milled with, or without, admixture with silicone fluids, soft greases are obtained. A proportion of tetrafunctional material may also be included.

The greases do not change in consistency between −45° and 250°C. and are insoluble in water and aqueous solutions. They are resistant to a wide variety of corrosive chemicals, and yet can keep leather and rubber gaskets soft and supple. They are advocated as lubricants for stopcocks, plug-cocks and ground-glass joints.

When admixed with additives such as metallic soaps, and carbon black, they are claimed to be suitable for lubricating bearings which must operate either at high or low temperatures, the limits being 200° and −70°C.

Large quantities of silicone grease were used during the war for sealing the ignition systems of aircraft engines and to prevent failure due to corona discharge. The grease, being a good lubricant for rubber, is used in the low-pressure bag moulding technique.

The long-chain dimethylsiloxane polymers are the raw materials for the production of silicone rubber. Unlike ordinary rubber, these gummy silicone polymers cannot be vulcanised with sulphur, but certain organic peroxides will produce a like effect.

The process is carried out by milling the gum, insert fillers and an organic peroxide to a smooth paste or dough, which is then moulded or extruded at 150°. Dimensional stability is thereby attained, but the full strength of the product is not reached until

it has been cured for several hours at above 200°. The compounds can also be used for coating and laminating. This novel elastomer is stable at 200° and is finding application as gasket material and as a flexible heat-resistant insulation.

Tensile strength is low compared with that of natural and synthetic rubber. Its resistance to abrasion and tear are poor, and it suffers from a fairly high degree of compression set at elevated temperatures. But these shortcomings are likely to be mitigated as development proceeds.

Water Repellency

Many silicones are highly water-repellent, and some may be used to render other surfaces hydrophobic. For example, glass and ceramics become water-repellent after brief contact with dimethyldichlorosilane even in vapour form.

Presumably superficial reaction occurs with atoms of the alkali metal and adsorbed water molecules to give a firmly-bound water barrier. The same result is obtained by treating with a dilute solution of a silicone fluid in an inert solvent, *e.g.*, carbon tetrachloride, and then baking for several hours at above 200°.

This effect has been utilised for improving the performance of ceramic and steatite parts of electronic components, particularly when exposed to humid tropical conditions. Filter-paper is waterproofed by a short exposure to the vapour of methyltrichlorosilane but water absorption is not affected. The pores of the paper are not blocked, as can be shown by passing air or almost any organic liquid through it.

Application to textile materials is under careful examination, but considerable difficulties must be surmounted before a commercial waterproofing process can be developed.

In conclusion, Dr. Hardy said that industrial silicones are still in the early stages of development, and they are still costly. Other heat-resistant insulating materials are under active development, and it will be interesting to watch their impact on the fields to which silicones have already laid claim.

Discussion

In the course of discussion, Dr. Hardy said that, while both the Grignard synthesis and the direct synthesis were being used in production of silicone material, the Grignard method was particularly valuable because it was highly flexible and would allow of the introduction of practically any of the materials, whereas the direct synthesis was limited to a few.

Dr. H. G. Rains asked what were the prospects of overcoming some of the difficulties with the silicones, mentioning their price and difficulties in pigmenting. The high stoving temperature and the long period of stoving represented a great disadvantage; and once the materials were stoved at the high temperatures they did not appear to be fully polymerised, for the films were not resistant to reagents such as petrol.

Dr. Hardy said he had not had close contact with any particular branch of the technology, and least of all in the formulation of paints, but he believed we could expect improvements in the future; they had been in use for a relatively short time. Cost was a considerable deterrent, but no doubt it would be reduced as production increased; in the stage in which new uses were being developed we could not expect the cost to be very low. He agreed with Dr. Rains' comment on the solubility of the resins in petrol; but he exhibited a sample of paint or enamel that he and his colleagues had produced at Teddington with their new resin, and invited opinion as to whether it represented an improvement.

Expectations Not Fulfilled

Dr. R. F. Bowles, who proposed the thanks of the meeting to Dr. Hardy, said they were fortunate to have had the subject presented by an organic chemist and an enthusiast, rather than from the commercial point of view. So many things had been said in favour of the silicones that some people had been vastly disappointed by the actual performance of the materials. He had tried to use them, expecting that they might have good adhesion to glass in certain circumstances, but he had been disappointed. Perhaps that was because we had approached the problem from the point of view of high pressure salesmanship; Dr. Hardy's paper would probably revive some of the enthusiasm that was felt two or three years ago.

In particular he was pleased that there was a direct method of synthesis by which we might visualise getting materials which were more likely to be of use in the surface coating industries than were the materials supplied at the moment, which obviously had been synthesised more for their electrical and other properties than for use in the paint and allied trades. Furthermore, the direct method of synthesis seemed to represent a very big advance over the Grignard reaction. But the commercial application of the Grignard reaction was a most astonishing feature for all organic chemical engineers, and we must take off our hats to the Americans for having used on a comparatively enormous scale the sort of reaction which some in student days had performed on half-gram samples.

Progress in Medicinal and Fine Chemicals—V

Economical Synthesis of the Penicillins

by G. COLMAN GREEN, B.Sc., F.R.I.C., A.M.I.Chem.E.

THE introduction of C^{14} through reactions involving $C^{14}O_2$ has been utilised by Dauben (*J. Amer. Chem. Soc.*, 1948, *70*, 1376) in the synthesis of palmitic acid and of tripalmitin labelled with C^{14}. For example, ethyl pentadecanoate was hydrogenated to *n*-pentadecanol, which was brominated to pentadecylbromide which, in turn, was reacted with magnesium. Radioactive carbon dioxide (from barium carbonate) was passed into the reaction mixture and the labelled palmitic acid isolated.

By this means C^{14} can be arranged to occupy the C-6 position in the chain and the fate of the chain, as opposed to the carboxylic group, may thereby be followed in biological reactions.

The importance of saccharide molecules with labelled C in various positions in elucidating the reactions in intermediary metabolism need hardly be emphasised. Putman *et al.* (*J. Biol. Chem.*, 1948, *173*, 785) have devised an elegant method for producing radioactive (C^{14}) starch, glucose, fructose and sucrose from plants photosynthesised in an atmosphere of radioactive carbon dioxide.

Severed Turkish tobacco leaves are placed in the dark for 24 hours to use up the reserve of carbohydrates. They are then exposed to light, with petiole immersed in nutriant solution and with leaf exposed to radioactive $C^{14}O_2$. After a suitable period, glucose, fructose and sucrose are extracted with dilute alcohol, the starch remaining in the alcohol-insoluble portion; 230 microcuries of C^{14} in 0.5 gram barium carbonate yielded 20-25 per cent starch on the dry basis of the alcohol-extracted material.

Alcohol Extract

The specific activity of this starch was from 0.48-0.72 microcuries per mg. By hydrolysis, labelled glucose could be obtained with a specific activity of 0.1 microcuries per mg. From the alcohol extract similarly labelled glucose, fructose and sucrose could be obtained.

A similar set of experiments is described by Arnoff (*Science*, 1947, *105*, 664) who examined the general distribution of C^{14} after the photosynthesis of barley seedlings in presence of $C^{14}O_2$. The largest part of the radioactive carbon was to be found in the material most subject to metabolic turnover, namely, sugars and aliphatic acids. Least was concentrated in lipids and carotenoids.

An important set of metabolic studies has been carried out by Weinhouse and Millington (*J. Amer. Chem. Soc.*, 1947, *69*, 3089) in connection with the Krebs citric acid cycle. These workers used acetate labelled with C^{13} and yeast as a convenient model organism. They were able to conclude that the conception in which the Krebs cycle was the chief oxidative process in yeast was correct.

An Independent Mechanism

Beyond this, however, other interesting points emerged. First, an asymmetrical C_6 acid rather than citric acid was found to be the direct participant in the cycle; second, all C_4 acids were not formed as a result of the cycle and that another independent mechanism existed.

Radioactive isotopes have already been applied in therapeutic techniques. These techniques are essentially radiation therapies and replace the use of radium. Instead of introducing radium into the system by surgical procedures an isotope is selected capable, first, of giving the required radiation and, second, of becoming concentrated in the particular tissue or organ.

Radioactive iodine and calcium are the only two isotopes which have been studied to any extent, mainly because, in the past, they have been most accessible. P^{32} has been widely used in polycythomia vera, a disease in which, due to excessive formation of erythroblasts (cells from which red blood cells develop) by the bone marrow, an excessive number of red corpuscles develop in the blood.

By this treatment of the disease remissions occur in 85 per cent of cases, but there is insufficient information to date to show whether or not relapses may be expected to be frequent. The leukæmias (a group of diseases characterised by marked increase of leucocytes in the blood, which usually end fatally) are also being treated with P^{32} with encouraging results.

Radioactive iodine has been used mainly to study thyroid function, as might be

expected in view of the fact that the iodine-containing thyrexine is characteristic of the thyroid gland in which it occurs in a conjugated form. Radioactive iodine concentrates itself in the gland and it may, therefore, be treated as a source of radiation for the treatment of malignant conditions of the gland.

Antibiotic Penicillin

The obtaining of highest possible yields is of the greatest commercial as well as medical importance in the production of the, by now, well-known antibiotic penicillin. The literature relating to the stimulation of enhanced yields by the addition of precursors is already considerable and has been referred to in earlier reviews.

The mechanism by which penicillin yields are enhanced by the addition of precursors to the fermentation medium is not clear, and there existed a number of possibilities, including the use by the mould of the precursor as a vitamin or growth promoter, as a " building block " to be incorporated into the mould mycelium, or as a direct participant in other metabolic processes.

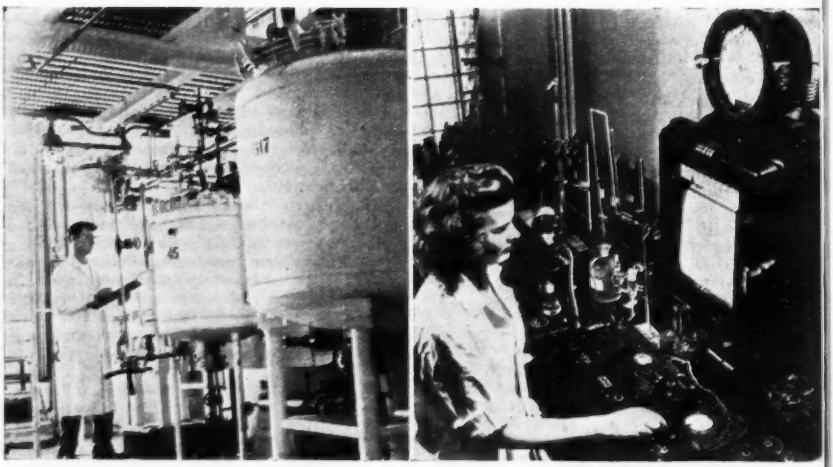
To ascertain whether the well-known penicillin yield promoter, phenylacetylvaline, was utilised, direct deutrio-phenylacetyl-DL-N^{15}-valine was added to the culture medium (*Science*, 1947, *106*, 504).

Deuterium analysis showed that 92.5 per cent of the precursor was utilised directly in the penicillin produced; but the phenylacetylvaline was not incorporated intact because only 2.6 per cent of the N^{15} was recovered in the penicillin. It was clearly demonstrated, therefore, that the phenylacetyl-moiety is incorporated in the penicillin molecule directly; but the fate of the amide portion (containing N^{15}) is obscure.

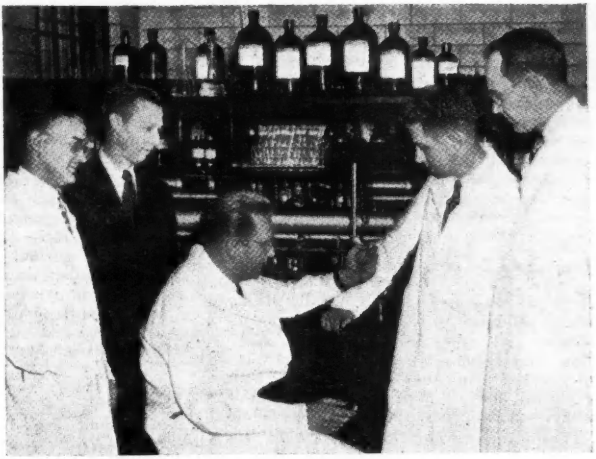
An isotope has proved of value in another respect in connection with the elucidation of the penicillin molecule. In 1944, when the chemical structure of penicillin was being thoroughly examined both in Great Britain and the U.S.A., it had been shown by the Lerewitinoff method that benzyl penicillin contained one active hydrogen atom. This was shortly confirmed by an exchange reaction between deutorium and the labile hydrogen in question.

Enhanced Yields

It will be recalled that the idea of obtaining enhanced yields of penicillin, as well as types of penicillin not normally produced by the mould, by the addition of precursors, flowed from the discovery of I.C.I. workers in 1944 that *P. notatum* produced principally benzyl penicillin on a medium containing corn steep liquor, whereas the same



Left: Equipment used in the final purification process which ends with crystallisation of the calcium chloride complex salt, the purest form of the drug streptomycin. Right: polarograph used in the analysis to determine the composition of streptomycin. Every step in the complex production operations is checked carefully by automatic control



Examining the crystals of Vitamin B_{12}. This team of five scientists in the Merck Research Laboratories which recently isolated the new vitamin comprises (left to right): Messrs. Frank R. Koniuszy, Karl A. Folkers, Edward L. Riches, Norman G. Brink and Thomas R. Wood

(" *The Merck Report* ")

strain of organism produced Δ^2-pentenyl penicillin on a synthetic medium.

It was soon found that benzyl penicillin production was stimulated by the presence of phenylalanine in the corn-steep liquor.

A whole range of new " un-natural " penicillins has been isolated in a crystalline form, following the addition of substituted phenylacetamides and other precursors of the fermentation medium.

Some of the these precursors are entirely biologically foreign, and an example is the production of *p*-tolyl-mercaptomethyl penicillin by the addition to the medium of the precursor N-(*p*-tolylmercapto acetyl)-DL-valine. By similar methods thienyl-acetyl-*p*-fluorobenzyl, phenoxyacetyl-, and *p*-iodobenzyl-penicillins have been produced among others.

The Aliphatic Penicillins

By contrast with the substituted benzyl penicillins no precursor has so far been found for the aliphatic penicillins (*e.g.*, pentenyl penicillin or F; *n*-heptyl penicillin or K).

In an important paper, Jarvis and Johnson (*J. Amer. Chem. Soc.*, 1947, *49*, 3010) have studied the rôle of constituents of synthetic media in penicillin production. They have elucidated the fact that the rate of penicillin formation was maximum under conditions supporting only slow rates of growth. On media supporting such slow rates of growth (lactose, glucose, ammonia, acetate, lactate and certain inorganic salts) a yield of over 300 units per ml. was obtained, which was sharply enhanced to 500 units per ml. by the addition of a precursor such as β-phenylethylamine at the rate of 0.1 per cent.

Biosynthesis

The biosynthesis of the various penicillins is discussed among the other very important aspects of the subject in " The Chemistry of Penicillin " edited by Dr. H. T. Clarke, Dr. J. R. Johnson and Sir Robert Robinson. This is the volume the publication of which has been eagerly awaited for a year or more. It has been produced under the joint auspices of the Medical Research Council of Great Britain and the Office of Scientific Research and Development in the U.S.A.

Unfortunately the accessibility of the work will be much reduced on account of its price—£9 9s. The chief aspects of the chemical work recorded in the volume have already been summarised in *Science*, 1945, *102*, 627; 1947, *105*, 653; and *Nature*, 1945, *156*, 766.

Penicillin is now produced in Britain and America by the deep-fermentation process on very large scales. The technique of manufacture by this means is now well understood and references have been made to this in earlier reviews.

It will be readily understood, however, that much of the current original work being carried out on penicillins is directed towards an attempt to establish an economical method of synthesis or to endeavour to ascertain the essential features of the structure of the penicillin molecule, to which its antibiotic activity may be attri-

buted, in the hope of synthesising simpler functional analogues.

Du Vigneaud and his co-workers (*J. Biol. Chem*, 1948, *176*, 893) have shown that D-benzyl-penicillinic acid synthesised from *d*-penicillamine hydrochloride and 2-benzyl-4-methoxymethylene-5(4)-oxazolone was identical with D-benzyl penicillinic acid prepared by the molecular re-arrangement of natural penicillin, (*i.e.*, D-benzyl penicillin).

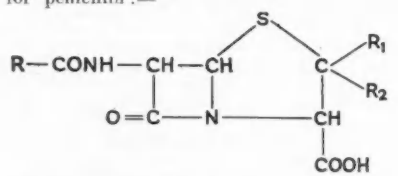
Benzyl-Penicillin

They have also shown that benzyl penicillin could be converted into antibiotically inactive D-benzyl penicillinic acid, which could be re-converted in small yield to benzyl-penicillin.

This, and other evidence, was used to show that D-benzyl penicillinic acid was an intermediate in the synthesis of benzyl penicillin from D-penicillamine and 2-benzyl-4-methoxylmethylene-5(4)-oxazolone.

These same workers (*J. Biol. Chem.*, 1948, *176*, 915) report the synthesis of other and new penicillins in small yields but in sufficient amount to enable them to be assayed against standard test organisms.

In the synthesis mentioned immediately above du Vigneaud has substituted other oxazolones which differ from the one mentioned by alternative groups in the 2-position. The resulting penicillins differ from benzyl penicillin in the nature of the R group on the basis of the lactam structure for penicillin :—



The intermediate *d*-benzyl penicillinic acid is very difficult to crystallise and so it was hoped that other oxazolones might, among other advantages, provide more readily crystallisable analogues. Consequently, synthesis was attempted by the condensation of 2-benzyl-4-methoxymethylene-5(4)-oxazolone with a number of α-amino-β-mercapto acids of which an example was DL-β-ethyl-β-methyl cysteine hydrochloride hydrate.

These cysteine derivatives were also condensed with 2-phenyl-4-ethoxymethylene-5(4)-oxazolone.

Crude salts of the resultant penicillins were obtained with activities of 0.015-0.50 units per mg. when assayed against *Staphylococcus aureus* H. The new penicillins, although in low yield, could be distinguished from each other by the effect on the test *Staphylococcus* and on *Bacillus subtilis* and *Vibrio metchnikovii*.

None of the penicillins were found to be effective against a range of micro-organisms known to be resistant to benzyl penicillin (Penicillin G).

It is a notable fact that of the four possible routes so far elucidated for the synthesis of penicillins (*E. Chain, Ann. Rev. Biochem.*, 1948, *17*, 696) only that followed by du Vigneaud in the work mentioned above, which depends upon the condensation of the various hydroxymethylene oxazolones with penicillamines or their equivalents, has so far yielded penicillin with unequivocal penicillin-like activity.

(*To be continued*)

NEW ANTIBIOTIC DRUG

LABORATORY tests are new being carried out with a new antibiotic drug, diplomycin, discovered by Dr. Karl Noster, a German bacteriologist.

Considerably more research will be necessary before the drug can be put on the market, but patients in several Hamburg hospitals are undergoing treatment with diplomycin for various diseases, including tuberculosis of the lungs.

The method of administration is by injection into the blood stream. So far even large doses appear to be harmless and devoid of any unpleasant symptoms.

A high degree of success is claimed to have been attained in purely laboratory tests, but it is still too soon to prove the efficacy of the hospital treatment.

New Safety Regulation Proposed

Amplifying the information recently given regarding the proposed amendment of the Poisons List and Rules, the Home Office states : The indication of character which will be prescribed for the labelling of agricultural and horticultural insecticides and fungicides containing dinitrocresols and certain phosphorus compounds is as follows :—

" Caution. This substance is poisonous. The inhalation of its vapour, mist, spray or dust may have harmful consequences. It may also be dangerous to let it come into contact with the skin or clothing."

Ambitious Plans for Indian Chemicals

Further Steps in the Development of National Resources

THE inadaquate use made of Indian molasses, potentially a valuable source of commercial alcohol, is receiving renewed attention from the industrial development committee, which claims that there are annually available from sugar factories 530,000 tons of molasses, capable of yielding about 33 mill. gal. of alcohol. Actual output, however, was said to amount to only 3 mill. gal., due to various difficulties. The immediate problem is to step up the production of distilleries to the installed capacity, and to this end steps are being taken to supply coal and additional tank wagons necessary to transport molasses and power alcohol.

Various targets for non-ferrous metals and sulphuric acid have been fixed and measures to attain these targets have been outlined in the recommendations submitted by the committees appointed for the purpose by the development committee. The targets for refined copper and electrolytic copper have been fixed at 7000 tons and 20,000 tons respectively.

The output sought for other metals is: Brass sheets 35,000 tons; aluminium 50,000 tons long term and 15,000 tons short term; aluminium sheets 25,000 tons long term and 10,000 tons short term.

The committee has suggested that the Government should have a comprehensive project report on the manufacture of electrolytic copper from copper-bearing scrap, and if the project is commercially sound that it should assist the company which has prepared the scheme to implement it. It is also suggested that a definite policy regarding protection for the aluminium industry should be announced for the encouragement of further development.

Sulphuric Acid and Soda Ash

The development committee on heavy chemicals suggested that the five-year target for the production of sulphuric acid should be 150,000 tons a year. India's existing capacity has now been expanded to produce 100,000 tons, the peak production being 62,500 tons in 1945. It was explained that upon the increased production of sulphuric acid depended the expansion of health activities in the Provinces and States.

The development of the soda ash and caustic soda industry depended upon the availability of salt and its price, stated the committee. Although the production of salt in recent months had increased, it was computed that unless salt was available at Rs. 14 to Rs. 15 a ton, as against its present price of Rs. 25 a ton in Kathiawar, it would not be possible for the Indian manufacturers to compete with those from abroad. The committee suggested that the Government should subsidise industrial salt, the total requirement being 500,000 tons a year.

Steps are being taken to arrange for the regular shipment of salt from South Indian sources, such as Tuticorin and other Madras ports, to Calcutta, so that at least 10 per cent of the requirements of West Bengal, Assam, Bihar and parts of Orissa and the United Provinces will henceforth bet met from Madras.

2·5 m. Tons of Salt

It was stated that if the progress achieved in production of salt were steadily maintained, and the transport position gradually improved, it might be possible to make the country self-sufficient in salt by the end of 1951. India's annual requirements in this respect are estimated to be roughly 2.5 million tons or 675 lakh maunds on the basis of 14 lb. per capita, as against 30 lb., the world's rate of consumption. It will be necessary to raise production by at least 10 to 15 per cent over the actual demand.

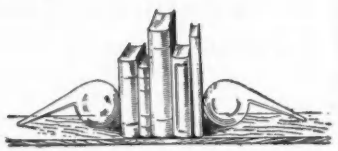
Reduction of Imports

Seventy per cent, or over 135 lakh maunds, of the salt imported by sea into Calcutta hitherto has been foreign, the balance coming from Kathiawar ports. Imports from Kathiawar are expected to rise, so that on the whole it is expected that foreign imports will be reduced from 70 per cent to 50 per cent of the requirements in 1949.

The committee recommended restriction of the import of soda ash, at the same time suggesting compulsion on the consumers to purchase some quantity of indigenous manufacture, the total production of which was expected to be 30,000 tons in 1948. Imports are expected to be 90,000 tons. There has been a glut of this commodity as the industries have not been able to consume the quantity available due to shortage of coal and transport.

There has been an increase in the production of caustic soda, but the committee suggested that unless means were found to increase the consumption of chlorine, no further licences for the production of caustic soda should be granted. The production of chlorine and bleaching powder had shown an upward trend.

A CHEMIST'S BOOKSHELF



The Pharmaceutical Pocket Book. London: The Pharmaceutical Press. 1948. Pp. x + 427. 12s. 6d.

The fifteenth edition of this well compiled book, originally produced in 1906, takes into account two events of outstanding importance to the practice of pharmacy: the National Health Service Act and the seventh British Pharmacopœia, which coincide with a new stage in the evolution of medicine and pharmacy—on the one hand in the organisation of professional services and on the other in the application of experience and research to the formulation of standards for drugs and pharmaceuticals. This comprehensive pocket book will serve to introduce to students of pharmacy the fundamental principles on which the practice of their profession is based, and will stand for practising pharmacists as a useful reference book. Its scope can be characterised as an abundance of details relating to the science and art of pharmacy. It contains numerous tables and concludes with a dictionary of synonyms and trade names. The book ought to be of great value to all those who carry on the business of chemists and druggists.

Distillation and Rectification. Dr. Emil Kirschbaum. New York: The Chemical Publishing Co., Inc. 1948. Pp. viii + 426. $10.

This is a translation from the German by authority of the Alien Property Custodian. It may be regarded as a classic of the important distillation and rectification industry and its first edition in English should prove a great help to many engineers. The translator, M. Wulfinghoff, who has been engaged in distillation work both in Europe and the U.S.A., does justice to the original and has included a résumé of current American practice in this special technique. The wide scope of the book is best illustrated by the following main topics with which it deals comprehensively: Fundamentals, theory, separation of liquids by simple distillation, the simple pot still, the rectifying column, continuous distilling equipment with rectifying and stripping sections, treatment of rectification using enthalpy-concentration diagrams, separating mixtures containing more than two components, determinating the dimensions of rectifying columns with interchanger plates, plate efficiency, rectification in packed columns, details of molecular distillation. The text is amplified with some 240 figures and five graphical folders.

The treatment of the subject is strictly scientific and structural details of apparatus and other factors important to a chemical engineer are given full consideration. General principles and generally suitable designs, rather than specific uses, are stressed. As far as possible, graphical methods are used in preference to involved calculations. The volume is altogether a comprehensive review which will serve well both the practising engineer and the student, presenting the results of research as well as engineering data in the field. The text is in a concise, coherent style which correlates some 120 specific references to original data in the literature. Mathematical formulæ, as well as involved and wordy theories, are avoided and the author has the fortunate faculty of expressing his ideas simply and directly.

Prevention of Iron and Steel Corrosion. C. Dinsdale. London: The Louis Cassier Co., Ltd. 1948. Pp. 67. 5s.

This is a compilation of processes and specifications relating to the prevention of the corrosion of iron and steel and the standards associated with it. The matter is divided into three parts dealing with methods of preventing corrosion (broken down into eleven groups), cleaning metal parts, and codes of practice. Two appendices deal with authorities issuing specifications and with paint and paint component specifications. The last should be of considerable practical value to a wide circle. Against a background of industrial requirements, the author has produced something of importance to engineers and others who are concerned with the preservation of machinery. The book contains 46 tables and concludes with a handy index. The whole presents in very small and compact form a serviceable compilation of practical data.

Personal

DR. JOHN F. THOMPSON has been elected president of the International Nickel Company, Inc., in succession to MR. ROBERT C. STANLEY, who continues as chairman. DR. PAUL D. MERIOA was elected executive vice-president and MR. HENRY S. WINGATE a vice-president in addition to his present office of secretary.

DR. EDWIN WARD TILLOTSON, an assistant director of the Mellon Institute of Industrial Research, is to be the recipient of the Bleininger Memorial Award of 1949 of the American Ceramic Society. The award is the highest honour conferred in America for "distinguished achievement in the field of ceramics." Dr. Tillotson's record of achievements goes back almost 40 years, to his early studies at the University of Kansas. The award also recognises his distinguished leadership of younger workers in the field of glass science and technology.

The Stockholm (Sweden) inventor, DR. FREDRIK LJUNGSTROM, has been awarded the James Watt medal of the Institution of Mechanical Engineers, London. Among his many inventions, Dr. Ljungström, who is 74, made an important contribution, during the war, to Sweden's fuel economy by his electro-thermic method for extracting oil from shale.

MR. C. L. SMITH, advertising manager of the Dunlop Rubber Company's tyre group at Fort Dunlop, will succeed Mr. Harold Eley as Dunlop's general advertising manager when the latter retires at the end of next month.

PROF. PETER J. W. DEBYE, of America's Cornell University, Nobel Prize winner in chemistry in 1936 and a foremost authority on molecular structure, is to receive, on May 20, the 1949 Willard Gibbs Medal of the Chicago section of the American Chemical Society. The medal, one of America's highest chemical honours, is given annually to recognise original contributions in pure and applied chemistry. Prof. Debye was a successor of Dr. Albert Einstein as professor of theoretical physics in the University of Zurich, and was director of the Max Planck Institute in Berlin from 1936 until he was ousted by the Nazis in 1940. In the U.S.A. since 1940 he has been a leader in the rapidly advancing branch of physical chemistry devoted to the fundamental study of the structure and particle size of high polymers, the multiple molecular structures making up rubbers, plastics and fibres. Prof. Deby has been particularly active in the development of the technique known as light scattering, the effect which enables scientists to measure accurately the size of polymer particles too small to be seen by existing means. His achievement was earlier recognised by awards of the Rumford, Farady, Lorentz, and Franklin Medals.

Mr. W. K. B. Marshall, who is to take up work next week as assistant director of research of the British Welding Research Association (*The Chemical Age*, 60, 272)

Two German Nobel laureates—DR. ADOLF BUTENANDT and DR. RICHARD KUHN—who were forced by Hitler to reject their awards in 1939, are, it is understood, to be given their prizes soon by the Swedish Academy of Science, the German News Agency, Dena, reports. The two scientists gained their awards for hormone and vitamin research

E. Boydell & Co., Ltd., the Manchester manufacturers of Muir-Hill dumpers, loaders and shunting tractors, have appointed MR. NORMAN LOE as representative in North-West England and North Wales. MR. WHITFIELD, who previously served in this capacity, becomes chief factory representative.

MR. ARTHUR HARTOG, joint vice-chairman of Lever Brothers & Unilever N.V., has been nominated by the French Government a Grand Officer of the Legion of Honour.

MR. J. C. A. PETERS, manager of the X-ray Export Department of Phillips Electrical, Ltd., has recently completed his 25th year with the Phillips organisation.

MR. F. HIRST SANDERSON, chief maintenance engineer of J. W. Leitch & Co., Ltd., chemical manufacturers, Milnsbridge, Huddersfield, left £1239 (£1157 net).

OBITUARY

BY the death of MR. JAMES MACGREGOR, who for almost half a century was associated with two companies whose record in chemical engineering covers nearly 125 years, a great loss is suffered by the industry and the profession. He was appointed Glasgow representative of Ernest Scott & Co., Ltd., and George Scott & Son (London), Ltd., in 1900, and on the retirement of Mr. Ernest Scott, in 1915, he, with two of his colleagues, acquired control of both companies. Later control passed entirely into his hands and he formed an association with Henry Balfour and Co., Ltd., of Leven, which, since Mr. MacGregor's retirement in 1944, has controlled both companies. Among Mr. MacGregor's first successes was the introduction of the Scott process of soda recovery, which is now in general use in the paper trade in Britain. He was also active in the development of many other branches of chemical engineering and was one of the founders of the Institution of Chemical Engineers. He represented the chemical and engineering group of the Glasgow and West of Scotland Section of the Society of Chemical Industry for many years and was a member of the council of the society. He was considered an authority on the subjects of evaporation, spray drying, distillation and general plant design.

The death is reported from Montreal on February 2, of MR. EDWARD TYGHE STERNE, aged 62, one of Canada's outstanding chemists. He gained his B.Sc. in 1913 at the Canadian Queen's University, where he lectured in chemistry for two years. During the First World War he was chief chemist at the Imperial Munitions Board. In 1919-20 Mr. Sterne was foreign technical representative for Shawinigan, Ltd., London, England. The following year he became associated with his father as chemical director of G. F. Sterne & Sons, Ltd., and later organised and became president of Sternson Structural Specialists, Ltd., and Sternson Laboratories, Ltd., Brantford, Ontario. He had been commissioner of the Ontario Research Commission since 1946, and was vice-president of National Silicates, Ltd., New Toronto, and a director of Guinite and Waterproofing, Ltd., Montreal, and of the Canadian Arsenals, Ltd. Since its inception Mr. Sterne had served as a commissioner of the Grand River Conservation Commission, and was a Fellow of the Canadian Institute of Chemistry and the Chemical Society of London. He was also an Associate of the Royal Institute of Chemistry, and member of the American Chemical Society, and of the Society of Chemical Industry.

23 NEW ARICs

THE Royal Institute of Chemistry has announced the names of 23 successful candidates who sat for the institute's examination for Associateship in January. The pass list comprises the following :—

BURBIDGE, Eric, Royal Technical College, Salford, and City Technical College, Liverpool; CHILD, William, B.Sc.(Lond.), Central Technical College, Birmingham; COPPOCK, Gordon, Technical College, Chesterfield; COX, John Edgar, City Technical College, Liverpool; DOWNES, Geoffrey Edwin, Stockport College and Royal Technical College, Salford; DREWERY, George, B.Sc.(Lond.), Northern Polytechnic, London; EDGE, Peter Frank, Central Technical College, Birmingham, and Technical College, Coventry; GILHOOLEY, Robert Aloysius, University of Sheffield and City Technical College, Liverpool; HOUCHELL, Peter Glynn, B.Sc.(Lond.), South-East Essex Technical College, Dagenham; KANE, Philip Francis, B.Sc.(Lond.), Woolwich Polytechnic; LITTLE, James, City Technical College, Liverpool; MCDONNELL, William Francis, City Technical College, Liverpool; MITCHELL, Brian Walter, B.A.(Camb.), University of Cambridge and Sir John Cass Technical Institute, London; OWEN, John Thomas Robert, Technical College, Cardiff; PINCHES, Philip Benjamin, B.Sc.(Lond.), Queen Mary College and West Ham Municipal College, London; RICHARDSON, Colin, West Ham Municipal College; SHEPHARD, Basil Robert, Acton Technical College; SIMMONS, Mrs. Margot, Chelsea Polytechnic, Birkbeck College, and The Polytechnic, Regent Street, London; SMITH, Edgar Vernon, City Technical College, Liverpool; TAYLOR, Arthur, B.Sc.(Lond.), Medway Technical College, Gillingham, Huddersfield, Halifax and Bradford Technical Colleges; WICKER, George Leonard, Royal Technical College, Salford; WINGROVE, David John, Sir John Cass Technical Institute, London; WOODWARD, Albert William Thomas, B.Sc.(Lond.), Northern Polytechnic, London.

Chemical Engineering History

Mr. George W. Riley, technical director of George Scott & Sons (London), Ltd., and Ernest Scott & Co., Ltd., chemical engineers, London, S.W.1, has received presentations of National Savings certificates, a fitted dressing-case, and an address on vellum at a luncheon in London commemorating the 50th anniversary of his joining the firm. Mr. W. Lindsay Burns, chairman of Henry Balfour & Co., Ltd., of Leven, Fifeshire, who presided, recalled that Mr. Riley had studied intimately both the engineering and the very intricate chemical sides of the business. Mr. Riley's was one of the finest brains in any country in this particular field.

Mr. Riley recalled his firm designing and supplying to the Royal Institute air and gas compressors capable of working up to 10,000 lb. pressure, with the assistance of which Prof. Dewar first liquefied air and fixed gases.

Long Service Diplomas.—Two employees of the Grangemouth S.C.W.S. soap works, Mr. John Grant, office superintendent, and Mr. David Kiddie, foreman, have been presented with diplomas in recognition of 50 years' service with the works. Mr. Grant, who is retiring, also received a cheque.

THE GOVERNMENT LABORATORY

Wide Scope of Analysis and Experiment

Dr. G. M. Bennett, Government Chemist

THE lecture room of the Royal Institute of Chemistry was filled to capacity on February 16, when the London and South Eastern Counties Section held its first meeting at headquarters for some time.

The large attendance gained a new conception of the work of the Government Laboratory in the course of a talk by Dr. G. M. Bennett, who offered ample evidence of the far-reaching character of the department s work, which is by no means confined to routine examinations.

The Government Laboratory, while intended mainly to serve other departments, was always ready to give advice to firms, or even individuals, Dr. Bennett recalled.

Since 1842

The origins of the laboratory dated back a little more than 100 years, from 1842, when the Board of Excise found it necessary to appoint chemists to examine tobacco for adulteration. The work of these specialists was gradually extended.

In 1875 the Board of Customs formed its own laboratory for the examination of tea, and this also developed to embrace other objects.

With the increasing work and growing need for accurate analysis, the two laboratories were united in 1894 under Prof. T. E. (later Sir Edward) Thorpe and three years later moved to their present premises, now unfortunately far too small. A new site which will permit a considerable expansion has been allotted to the laboratory and it is hoped these new quarters will be ready about two years hence.

In 1911 the laboratory officially became a separate department with Sir James Dobie as the first Government Chemist.

Many Functions

The great diversity of work covered by the laboratory was probably not fully realised. Under the Drugs Act it was liable to be called in as referee in any disputes. Other duties included geological survey; testing samples for the Ministry of Food; examination of all materials for the Ministry of Works; supervision of water supplies throughout the United Kingdom; and even the examination of disputed documents for the detection of forgeries.

Since 1900 the laboratory had controlled the food and drug supplies for the Army, work which naturally increased considerably during the war when seven branches were engaged, of which three were still active.

The wide range of problems that had to be solved extended from full scientific investigations which might cover a period of years to the examination of several thousand samples a week, year in and year out.

Analytical and Constructive

As some of the examples of recent work undertaken by the laboratory Dr. Bennett mentioned four of particular interest. The examination of a natural gas from Tanganyika; investigation by X-ray powder method of factory dusts for the presence of silica, this being undertaken for a medical survey that is in progress; designing a portable oxygen generating outfit for the next Everest expedition; and finally, the determination of lead, zinc and fluorine in bones which assisted the geologists to determine the age of fossils.

The speaker went on to particular aspects of the laboratory work which were illustrated by some interesting slides. The first subject was that of food analysis, and slides showed the various tests of tasting, moisture, baking, etc., carried out at the Liverpool laboratory, concluding with an illustration of a machine which enabled several of these tests to be carried out at the same time.

It was shown how important it was that sugar should be correctly examined, as a very large increase in duty payable could arise over only a few degrees of difference in polarimetry.

Finally, the extremely difficult question of

(*Continued at foot of next page*)

Next Week's Events

MONDAY, FEBRUARY 28

Birmingham University Chemical Society. Edgbaston: University, 4.30 p.m. Dr. Geoffrey Gee: "Certain Aspects of the Chemistry of Rubber."

The Chemical Society. Eire: Dublin University College, 7.45 p.m. Joint meeting with University College of Dublin Chemical Society and the Werner Society. Prof. T. Dillon: "Researches on the Chemistry of Algae." Oxford: Physical Chemistry Laboratory, 8.15 p.m. (with the Royal Institute of Chemistry). C. S. Robinson: "Research and Productivity in Industry."

Royal Society of Arts. London: John Adam Street, Adelphi, W.C.2, 8 p.m. Cantor lecture. W. H. J. Vernon: "The Corrosion of Metals—II."

TUESDAY, MARCH 1

Hull Chemical Society. Hull: Church Institute, Albion Street, 6.30 p.m. Joint meeting with the Yorkshire Section, S.C.I. R. Gane: "Refrigeration in Food Technology."

Institute of Metals. (South Wales Local Section). Swansea: University College, Singleton Park, 6.30 p.m. Annual general meeting and students' discussion.

WEDNESDAY, MARCH 2

Institute of Welding. Manchester: Reynolds Hall, College of Technology, 7 p.m. D. M. Kerr: "Fundamentals in Welding Costs."

Manchester Metallurgical Society. Manchester: Engineers' Club, 6.30 p.m. C. G. Conway: "Metallurgical Problems Involved in the Manufacture of Components for Jet Engines."

THURSDAY, MARCH 3

The Chemical Society. London: Burlington House, W.1, 7 p.m. Reading of original papers. Sheffield: University, 5.30 p.m. Prof. J. W. Cook: "The Chemistry of Colchicine."

Institute of Metals. (Birmingham Local Section). Birmingham: James Watt Memorial Institute, 6.30 p.m. D. A. Oliver: "The Technical Significance of the Sigma Phase."

Leeds Metallurgical Society. Leeds: University, 7 p.m. E. W. Colbeck: "Metallurgical Problems in the Field of Atomic Energy."

Institute of Packaging. London: Waldorf Hotel, Aldwych, W.C.2, 6 p.m. J. Castle: "Corrugated Containers."

FRIDAY, MARCH 4

Society of Chemical Industry. London: E.L.M.A. Lighting Service Bureau, 2 Savoy Hill, W.C.2, 6 p.m. Joint meeting with the London Group, Industrial Applications Section of the Royal Statistical Society. K. A. Brownlee: "The Use of the Factorial Experiment for Investigating Chemical Processes."

The Chemical Society. Newcastle-on-Tyne: King's College, 5 p.m. Reading of original papers.

The Royal Institution. London: 21 Albemarle Street, W.1, 9 p.m. E. K. Rideal: "The Foundation of the Royal Institution (March 7, 1799)."

THE GOVERNMENT LABORATORY

(Continued from previous page)

moisture determination in tobacco was considered. The ideal method would, of course, be the use of vacua at laboratory temperature, but this was obviously not practicable where it was necessary to deal with two to three thousand samples a week.

The procedure had been to place the samples in electric ovens at night for a period of 15 hours, after which they were transferred to water-cooled compartments for about 20 minutes and then weighed. Electric fans helped to blow hot air through at a fixed rate and keep the temperature uniform throughout the oven.

A homogeneous example of tobacco was of course necessary, but the loss of weight at a given temperature was found by no means to be constant unless the air factor was also constant. An anomaly lay in the fact that the law was concerned only with the moisture at a certain temperature.

PRODUCTIVITY COUNCIL

SIR FREDERICK BAIN, deputy chairman of I.C.I., Ltd., is named among the members of a council of management which will control the Anglo-American Council on Productivity (United Kingdom Section), Ltd. This was registered last week as a company without capital to implement the policy of the British and American scheme for improving production methods here. Other members of the council, on which employers and trades union secretaries are equally represented, are:—Mr. Arthur C. Baines, Sir Peter F. B. Bennett, Mr. Kenneth J. Burton, Mr. Cuthbert B. Clegg, Mr. Arthur Deakin, Sir Maurice E. Denny, Mr. Lincoln Evans, Sir Norman V. Kipping, Sir Wm. Lawther, Sir Greville S. Maginnis, Mr. Andrew Neasmith, Mr. Jack Tanner, Mr. Harold V. Tewson, Sir John B. F. Watson, and Mr. Thos. Williamson. The secretary is Mr. A. S. Cash.

Home News Items

OCCA Dinner.—The dinner and dance held recently by the London section of the Oil and Colour Chemists' Association, at the Criterion Restaurant, Piccadilly Circus, W.1, was presided over by Mr. David E. Roe, chairman of the section, and among those also present were Dr. L. A. Jordan (OCCA national president) and Mrs. Jordan.

Costly Oil Blaze.—Damage estimated at £25,000 was caused on February 19 when about 100,000 gal. of lubricating oil caught fire at the Alma Oil Mills, Hyde, Cheshire, owned by Fletcher Miller, Ltd. The garage and loading way, eight heavy lorries, and a tanker were destroyed as well as thousands of gallons of oil and lubricants.

Coal Output.—Britain's total production of coal last week was 14,100 tons below that of the previous week, but represented an increase of 171,300 tons over the corresponding week of last year. Comparative figures are:—Last week: 4,296,300 tons (4,081,800 tons deep-mined, 214,500 tons opencast). Previous week: 4,310,400 tons. Week ended February 21, 1948: 4,125,000 tons.

I.C.I. Amenities.—Tenants of a corrugated iron bungalow village in mid-Cheshire, are being moved week by week to a new village constructed for I.C.I., Ltd., at Marbury Hall, site of the P.o.W. camp during the war. Buildings that have been renovated at a cost of £500 each—and transformed into "model" homes at rents of 10s. a week. Marbury Hall estate will become a self-contained village for I.C.I. workers.

Research Conference.—A five-day conference of the International Scientific Committee for Trypanosomiasis was concluded at the Colonial Office, London, last week. The meeting was given further details about Antricide by Dr. D. Garnet Davey of the Tropical Diseases Unit in Africa of I.C.I., Ltd. Scientists from Britain, France, Belgium, Portugal, South Africa and Southern Rhodesia attended, and it was concluded that further research was needed.

Productivity Group Becomes Private Company.—It was announced in London this week that the United Kingdom section of the Anglo-American Council on Productivity has been constituted a private company limited by guarantee. This is mainly to facilitate business matters, particularly financial arrangements. Sir Thomas Hutton, a former secretary to the Government of India, and regional officer for health services at the Ministry of Health since 1947, was appointed general manager.

Import Licences.—The Board of Trade announces that from March 1, licences will be granted to applicants to import North American natural asphaltum, for approved purposes, irrespective of whether they are members of the North American Natural Asphaltum Importers' Association or not.

The Atomic Clock.—The possibility that the atomic clock might be substituted for the present time keeping apparatus at Greenwich is reported by *Reuter*. Sir Harold Spencer Jones, the Astronomer Royal, at present touring California, is said to have stated that the American atom clock seems to be "an almost absolute measure of time."

X-ray Welding Tests.—The system of co-operative X-ray examination of welding construction proposed some months ago by the Clyde shipbuilding industry has now been developed with marked success. Three types of X-ray units, owned by firms, are made available to all, permitting Clyde yards to offer instrument control of the efficiency of their welding.

Fertiliser Service.—Western Spreaders, Ltd., of Glasgow, has launched a scheme for the distribution of Welsh limestone direct to Scottish farms. The company is transporting the lime in specially chartered boats and undertaking contract work for spreading it. Sea delivery and co-ordinated organisation is said to effect considerable saving in costs.

250,000 Tons of Diatomite.—By draining Loch Cuither, Skye, it is expected that 250,000 or 300,000 tons of diatomite of very high quality will be recovered. Some of the deposits are known to lie 52 ft. below the surface. The Scottish Office, it is stated, will collaborate by building roads in the neighbourhood to assist the exploitation of the deposits by the Glasgow firm of R. D. Miller.

Zoning Order Enforced.—The first Liverpool prosecution under the Town and Country Planning Act of 1947 came before the Liverpool Stipendiary Magistrate on February 16. Mr. Lionel Cogan and Mr. Morris Carpenter, trading as Hi-gene Cleanser Products, were fined 20s. each on an accusation of having used premises, 14 Linnet Lane, Liverpool, for industrial purposes in contravention of an enforcement notice dated October 7, 1948. Since May, 1948, Cogan and Carpenter were alleged to have infringed the zoning order by using the ground floor of the premises for making and bottling liquid soap and liquid bleach.

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

HUFFER & SMITH, LTD. (formerly H. H. Huffer & B. A. Smith, Ltd., & H. H. Huffer & Co., Ltd.), Thornton Heath. (M., 26/2/49.) January 7, £2500 (not ex.) charge, to Lloyds Bank, Ltd.; charged on New Era Works, Purley Way, Croydon. *Nil. November 3, 1947.

PAL CHEMICALS, LTD., London, S.W. (M., 26/2/49.) January 6, two mortgages, to Martins Bank, Ltd., each securing all moneys due or to become due to the Bank; respectively charged on land at Maidenhead, with plant, fixtures, etc., and 79-81 Scrubbs Lane, Hammersmith, with plant, fixtures, etc. *£2428. May 20, 1948.

SOUTHERN HUMUS, LTD., Hove. (M., 26/2/49.) January 6, £200 first debenture, to J. C. J. Clark, Hove; general charge.

Satisfactions

ENGLISH STEEL CORPORATION, LTD., Sheffield. (M.S., 26/2/49.) Satisfactions January 12, of Trust Deed registered October 7, 1932, and supplemental deeds registered January 16, 1935, and December 1, 1936, to the extent of £26,492.

EVANS RESIDUES, LTD., Boreham Wood. (M.S., 26/2/49.) Satisfaction January 7, of debenture registered November 6, 1943.

KING & KING (CHEMISTS), LTD., Bristol. (M.S., 26/2/49.) Satisfaction January 7, of charge registered June 27, 1947, to the extent of £18,884 6s. 4d.

PAL CHEMICALS, LTD., London, S.W. (M.S., 26/2/49.) Satisfaction January 13, of mortgage registered April 1, 1948.

Company News

The following increases in registered capital are announced: **Hess Products, Ltd.**, from £45,000 to £273,000; **Feedstuffs, Ltd.**, from £30,000 to £40,000; **Vivus Products, Ltd.**, from £1000 to £2000.

The name of Pest Control Holdings, Ltd., has been changed to **Pest Control, Ltd.**

New Companies Registered

Aeravap Ireland, Ltd. (12,784). Private company. Capital £5000. Manufacturers and hirers of apparatus and machinery for air-disinfecting, purifying, sterilising, etc. Subscribers: J. Maybury, 19 Botanic Avenue, Glasnevin, Dublin.

Alulglas, Ltd. (464,221). Private company. Capital £200. Objects: To make arrangements whereby inventions and results of research in all branches of science and industry may be investigated and further developed; to manufacture and produce machinery and plant; and manufacture anti-corrosive and anti-fouling compositions, paints, oils, paint removers, dyes, colours and chemical preparations, etc. Directors: R. P. Fraser, V. C. Hanson. Reg. office: Duke's Court, 32 Duke Street, St. James's, S.W.1.

Industrial & Agricultural Supplies (Buxton), Ltd. (464,449). Private company. Capital £2000. Agricultural, horticultural and chemical engineers, horticultural and agricultural manufacturing chemists and distillers, etc. Directors: T. Hartle, R. H. Burgiss. Reg. office: 12 Grange Road, Buxton, Derbyshire.

Norman Hampson, Ltd. (464,338). Private company. Capital £2000. Manufacturers, processors and moulders of perspex, plastic materials, etc. Directors: W. H. Turner, F. Booth, N. Hampson. Reg. office: 86a Manchester Road, Hyde.

M. Perrell & Co., Ltd. (464,589). Private company. Capital £100. Manufacturers and agents for the exploitation of special chemical formulæ, and the distribution of chemical preparations and products, etc. Directors: M. Perelmutter, 31 Chesterfield House, South Audley Street, W.1.

Sleepax, Ltd. (462,612). Private company. Capital £5000. Manufacturers of chemicals, gases, drugs, etc. Directors: E. G. Holmes, S. S. Gibbins. Reg. office: 274 Gresham House, Old Broad Street, E.C.2.

C. J. Spencer (Stafford), Ltd. (462,758). Private company. Capital £100. Manufacturers of plastic substances, sheets, etc. Director: E. T. Pryce-Jones, 61 Villa Road, Handsworth, Birmingham.

Tempering Salts & Fluxes, Ltd. (463,009. Private company. Capital £1000. Smelters, refiners, metallurgists, chemists, etc. Directors: J. Z. Ashlyn, and J. S. Wright. Reg. office: 4 Wareham Street, S.E.5.

Texas Oil Co., Ltd. (463,272). Private company. Capital £100. Refiners of petroleum and other oils and products; to acquire petroleum or oil bearing lands, etc. Reg. office: 117 Park Street, W.1.

Chemical and Allied Stocks and Shares

STOCK markets, although steadier, remained inactive, the view gaining ground that it is difficult to assess the outlook until after the Budget. Commodity and kindred shares have so far shown little recovery from their recent decline, but British Funds remained firm in anticipation of the New Zealand loan going to a small premium when dealings start. Industrial shares moved narrowly, but were firmer, reflecting hopes that there may be some modification of the dividend limitation request. The FBI is likely to make a statement shortly, based on replies received to its questionnaire to individual companies. This, it is expected in the City, will be followed by a pronouncement from Sir Stafford Cripps on the form in which he desires dividend limitation to continue during the next 12 months.

There have been only small movements in chemical and kindred shares, although generally they were firmer under the lead of Imperial Chemical, which strengthened to 47s. 3d. The market is continuing to expect that the I.C.I. dividend will be maintained at 10 per cent on the larger capital. Monsanto Chemical, however, have receded from 62s. 6d. to 60s. Turner & Newall became firmer at 84s., the 4s. units of the Distillers Co. were 28s. 4½d., and Albright & Wilson 5s. shares again changed hands around 31s. 3d.

Elsewhere, Amber Chemical 2s. shares strengthened to 9s. 6d. on expectations that the prospectus estimate of a 35 per cent dividend total will be realised. Fisons remained in favour, changing hands up to 60s. 9d., and William Blythe continued to reflect expectations of good financial results, business in these 2s. shares being around 21s. 3d. Bowmans Chemicals 4s. shares were 7s. 6d., United Molasses 47s. 6d., and Associated Cement improved to 80s. on market expectations that the total distribution will be maintained, including the special payment made last year. Borax Consolidated, although again lower on balance at 56s. 3d., became firmer, awaiting the full results and the annual statement.

British Glues 4s. shares were 21s. 6d., and British Aluminium at 51s. 3d. were steady in anticipation of the results showing a good increase in profits, but no change in dividend is, of course, expected at this stage. British Oxygen at 101s. 10½d. were firm, as were General Refractories at 23s.

Movements in the plastics section have been small. British Xylonite were £5⅝, De La Rue 38s. 6d., and British Industrial Plastics 2s. shares 6s. 7½d. In metal industries, Amalgamated Metal remained around 20s. 3d., and Goodlass Wall 10s. shares at 38s. 6d. have been more active, the market view being that the past year's results are likely to show a further increase in earnings.

Iron and steels became more active with Sheepbridge higher at 66s. 6d. now that the company's engineering section has been freed from nationalisation. Staveley eased to 87s. 6d., Guest Keen were 49s. 6d., United Steel 30s. 3d., and Clarke Chapman at 56s. 3d. responded to the higher profits for the past year.

Elsewhere, Glaxo Laboratories were dealt in around £22. British Drug Houses were 8s. 9d., and Boots Drug 5s. shares eased to 55s. 3d. Lever & Unilever N.V. at 45s. have rallied following the company's capital plans. Lever & Unilever showed steadiness at 48s.

Tube Investments firmed up to 63. Triplex Glass have been steady at 23s. 6d.

Oils were firmer and showed a little recovery from their recent set-back. Anglo-Iranian were £3⅜, Shell 71s. 10½d., while Burmah Oil on the prospect of co-operation with the Burmese Government rallied to 68s. 9d.

New Factories

Of the six new factories now under construction at the Lamberhead Industrial Estate, Pemberton, Wigan, the largest will be leased to the Triangle Valve Co., Ltd., Hulme, Manchester, and will employ about 400 men this summer on the manufacture of engineering valves for oil companies. Two factories will be occupied by Blackburn & Oliver, Ltd., Cleckheaton, Yorkshire, for the production of plastic bobbins and tubes for the textile trade.

Two other major Wigan developments, a large factory for British Celanese, Ltd. (rayon), at Goose Green, and a £1 million factory for Turner Bros. Asbestos Co., Ltd. (belting), at Hindley Green, are also expected to commence production soon.

U.K. Copper Stocks

Mr. F. J. Erroll asked the Minister of Supply in the House of Commons, what is the size of the present stocks of copper in Britain under his control; and if supplies to manufacturers will be assured at their present level during 1949. In a written reply, Mr. G. R. Strauss said the Ministry of Supply's stocks of virgin copper in the United Kingdom on December 31, 1948, amounted to 98,000 tons. Contracts had been made to cover adequately consumers' estimated requirements for 1949, he said.

Prices of British Chemical Products

THERE has been little development of outstanding interest in the industrial chemical market during the past week. The volume of overseas inquiry is again good and actual bookings for export continue to be maintained at a good level. The movement to the home consuming industries against contract commitments has been reported as substantial and a fair amount of domestic booking has been taking place. The price position throughout remains strong, particularly for such items as chlorate of soda, nitrate of soda and caustic soda, as well as the potash compounds. There is a quiet but steady call for the non-ferrous metal compounds, prices for which remain unchanged. Among the acids, oxalic continues firm in good request, while the supply position of acetic acid is easier. There is a seasonal demand for tartaric and citric acids, quotations for which remain at recent levels. Steady trading conditions obtain in the coal tar products market. Buying for export has been on a moderate scale, with good shipments of pitch and creosote oil.

MANCHESTER.—Very little alteration in trading conditions on the Manchester chemical market has been reported during the last week. Deliveries of alkali and other chemicals to the textile bleaching, dyeing and finishing industries have been maintained at a good level and specifications from the other principal industrial outlets are circulating steadily. Replacement buying on home-trade account during the week has been on a satisfactory scale and inquiries have covered a wide range. The movement of the compound and other fertiliser materials is expanding and active trading conditions in a number of directions are anticipated during the coming months.

GLASGOW.—There has been little change in the Scottish chemical market during the week, although a slight improvement was recorded over previous weeks. In general, however, the market is still depressed. The demand for formaldehyde for horticultural purposes has started rather earlier this year, which is probably due to the early spring weather. Similar remarks apply to fertilisers. Potassium nitrate is still in very short supply, delivery requiring from two to three months. There is still a good demand for magnesite and magnesium chloride, the supply position of the latter now being very much easier. Sales of whiting have been about normal, but with a few new demands. The export market continues to be lively, with steady booking of orders. It is particularly satisfactory to note that repeat orders are coming in, particularly from hard currency areas where previously supplies were being obtained from other countries.

Price Changes

Rises: Lead acetate, potassium iodide, caustic soda, sodium bicarbonate, sodium chlorate, sodium nitrate, sodium nitrite, sulphuric acid, antimony sulphide, lithopone, ammonium sulphate, cresylic acid, pyridine.

Reductions: Sodium acetate, sodium metasilicate, naphtha.

General Chemicals

Acetic Acid.—Maximum prices per ton: 80% technical, 1 ton, £64; 80% pure, 1 ton, £66; commercial glacial 1 ton £79; delivered buyers' premises in returnable barrels: £4 10s. per ton extra if packed and delivered in glass.

Acetic Anhydride.—Ton lots, d/d, 11¾d. per lb.

Acetone.—Maximum prices per ton, 1/5 tons, £76 10s.; single drums, £77 10s.; delivered buyers' premises in returnable drums or other containers having a capacity of not less than 45 gallons each. For delivery in non-returnable containers of 40/50 gallons, the maximum prices are £3 per ton higher. Deliveries of less than 10 gallons free from price control.

Alcohol, Industrial Absolute.—50,000 gal. lots, d/d, 2s. 7¾d. per proof gallon; 5000 gal. lots, d/d, 2s. 10¾d. per proof gal.

Alum.—Loose lump, £17 per ton, f.o.r. MANCHESTER: £17.

Aluminium Sulphate.—Ex works, £11 10s. per ton d/d. MANCHESTER: £11 10s.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Bicarbonate. — MANCHESTER: £48 per ton d/d.

Ammonium Carbonate.—£48 per ton d/d in 5-cwt. casks. MANCHESTER: Powder, £50 d/d.

Ammonium Chloride. — Grey galvanising, £22 10s. per ton, in casks, ex wharf. Fine white 98%, £21 to £25 per ton. See also Salammoniac.

Ammonium Nitrate.—D/d, £18 to £20 per ton.

Ammonium Persulphate.—MANCHESTER: £5 per cwt. d/d.

Ammonium Phosphate.—Mono- and di-, ton lots, d/d, £78 and £76 10s. per ton.

Antimony Oxide.—£162 10s. per ton.

Antimony Sulphide.—Golden, d/d, as to quantity, etc., 4s. to 5s. per lb.

Arsenic.—Per ton, £40 5s. to £41 5s., according to quality, ex store.

Barium Carbonate.—Precip., d/d; 2-ton lots, £25 15s. per ton, bag packing, ex works.

Barium Chloride.—£35 to £35 10s. per ton.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £26 10s. per ton d/d; 2-ton lots, £26 15s. per ton.

Bleaching Powder.—Spot, 35/37%, £11 10s. per ton in casks.

Borax.—Per ton for ton lots, in free 1-cwt. bags, carriage paid: Commercial, granulated, £30; crystals, £31; powdered, £31 10s.; extra fine powder, £32 10s. B.P., crystals, £39; powdered, £39 10s.; extra fine, £40 10s. Borax glass, per ton in free 1-cwt. waterproof paper-lined bags, for home trade only, carriage paid: lump, £77; powdered, £78.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid: Commercial, granulated, £52; crystals, £53; powdered, £54; extra fine powder, £56. B.P., crystals, £61; powder, £62; extra fine, £64.

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid, £8 12s. 6d. per ton, in 4 ton lots.

Charcoal, Lump.—£25 per ton, ex wharf. Granulated, £30 per ton.

Chlorine, Liquid.—£29 per ton, d/d in 16/17-cwt. drums (3-drum lots).

Chrometan.—Crystals, 5⅝d. per lb.

Chromic Acid.—1s. 10d. to 1s. 11d. per lb., less 2½%, d/d U.K.

Citric Acid.—Controlled prices per lb., d/d buyers' premises. For 5 cwt. or over, anhydrous, 1s. 6¾d., other, 1s. 5.; 1 to 5 cwt., anhydrous, 1s. 9d., other, 1s. 7d. Higher prices for smaller quantities.

Cobalt Oxide.—Black, delivered, 7s. 7d. per lb.

Copper Carbonate.—MANCHESTER: 1s. 6½d. per lb.

Copper Chloride.—(53 per cent), d/d, 1s. 10½d. per lb.

Copper Oxide. — Black, powdered, about 1s. 4½d. per lb.

Copper Nitrate.—(53 per cent), d/d, 1s. 8½d. per lb.

Copper Sulphate.—£42 10s. per ton f.o.b., less 2%, in 2-cwt. bags.

Cream of Tartar.—100%, per cwt., from 152s. per 1-2 cwt. lot, d/d.

Ethyl Acetate.—10 tons and upwards, d/d, £115 per ton.

Formaldehyde.—£31 per ton in casks, according to quantity, d/d. MANCHESTER: £32.

Formic Acid.—85%, £64 per ton for ton lots, carriage paid. 90%, £67 5s. per ton.

Glycerine.—Chemically pure, double distilled 1260 s.g., 123/1 per cwt. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 1d. to 2s. 3d. per lb.; carriage paid for bulk lots.

Hydrochloric Acid.—Spot, 7s. 6d to 8s 9d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Hydrogen Peroxide.—1s. 0½d. per lb. d/d, carboys extra and returnable.

Iodine.—Resublimed B.P., 10s. 4d. to 14s. 6d. per lb., according to quantity.

Iron Sulphate.—F.o.r. works, £3 15s. to £4 per ton.

Lactic Acid.—Pale, tech., £70 per ton; dark tech., £60 per ton ex works; barrels returnable.

Lead Acetate.—White, 130s. to 138s. per cwt.

Lead Carbonate.—British dry, ton lots, d/d. £146 per ton.

Lead Nitrate.—About £135 per ton d/d in casks. MANCHESTER: £125.

Lead, Red.—Basic prices per ton: Genuine dry red lead, £137 10s.; orange lead, £149 10s. Ground in oil: red, £159 10s., orange, £171 10s. Ready-mixed lead paint: red, £163, orange, £175 (subject to increase of £1 10s. per ton).

Lead, White.—Dry English, in 8-cwt. casks, £146 per ton. Ground in oil, English, in 5-cwt casks, £167 per ton.

Lime Acetate.—Brown, ton lots, d/d, £18 to £20 per ton; grey, 80-82 per cent, ton lots, d/d, £22 to £25 per ton.

Litharge.—£137 10s. per ton.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £18 5s.

Magnesium Carbonate.—Light, commercial, d/d, £70 per ton.

Magnesium Chloride.—Solid (ex wharf), £27 10s. per ton.

Magnesium Oxide.—Light, commercial, d/d, £160 per ton.

Magnesium Sulphate.—£12 to £14 per ton.

Mercuric Chloride.—Per lb., for 2-cwt. lots, 7s. 6d.; smaller quantities dearer.

Mercurous Chloride.—8s. to 9s. per lb., according to quantity.

Mercury Sulphide, Red.—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.

Methanol.—Pure synthetic, d/d, £28 to £38 per ton.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 4s. 8d. per gal.; pyridinised 64° O.P. 100 gal., 4s. 11d. per gal.

Nickel Sulphate.—F.o.r. works, 3s. 4d. per lb.

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—£128 to £133 per ton packed in free 5-cwt. casks.

Paraffin Wax.—Nominal.

Phosphoric Acid.—Technical (S.G. 1.500), ton lots, carriage paid, £61 per ton; B.P. (S.G.1.750), ton lots, carriage paid, 1s. 1d. per lb.

Phosphorus.—Red, 3s. per lb. d/d; yellow, 1s. 10d. per lb. d/d.

Potash, Caustic.—Solid, £65 10s. per ton for 1-ton lots; flake, £76 per ton for 1-ton lots. Liquid, d/d, nominal.

Potassium Bichromate. — Crystals and granular, 9¾d. per lb.; ground, 10¾d. per lb., for not less than 6 cwt.; 1-cwt. lots, ½d. per lb. extra.

Potassium Carbonate.—Calcined, 98/100%, £64 per ton for 1-ton lots, ex store; hydrated, £58 for 1-ton lots.

Potassium Chlorate.—Imported powder and crystals, nominal.

Potassium Chloride.—Industrial, 96 per cent, 6-ton lots, £16.10 per ton.

Potassium Iodide.—B.P., 11s. 1d. to 12s. per lb., according to quantity.

Potassium Nitrate.—Small granular crystals, 76s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 8½d. per lb. for 1-cwt. lots; for 3 cwt. and upwards, 1s. 8d. per lb.; technical, £7 14s. 3d. to £8 6s. 3d. per cwt., according to quantity d/d.

Potassium Prussiate.—Yellow, nominal.

Salammoniac.—First lump, spot, £48 per ton; dog-tooth crystals, £50 per ton; medium, £48 10s. per ton; fine white crystals, £21 to £25 per ton, in casks, ex store.

Salicylic Acid.—MANCHESTER: 1s. 11d. to 3s. 1d. per lb. d/d.

Soda Ash.—58° ex depôt or d/d, London station, £7 12s. 6d. to £8 7s. 6d. per ton.

Soda, Caustic. — Solid 76/77%; spot, £19 per ton d/d.

Sodium Acetate.—£41-£55 per ton.

Sodium Bicarbonate.—Refined, spot, £11 10s. per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 8d. per lb.; anhydrous, 7½d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite. — Powder, 60/62%, £28 7s. 6d. per ton d/d in 2 ton lots for home trade.

Sodium Carbonate Monohydrate.—£25 per ton d/d in minimum ton lots in 2-cwt. free bags.

Sodium Chlorate.—£52 to £57 per ton.

Sodium Cyanide.—100 per cent basis, 8d. to 9d. per lb.

Sodium Fluoride.—D/d, £4 10s. per cwt.

Sodium Hyposulphite.—Pea crystals 22s. 6d. per cwt. (2-ton lots); commercial, 1-ton lots, £16 per ton carriage paid. Packing free.

Sodium Iodide.—B.P., 10s. 2d. per lb. to 12s. 1d. according to quantity.

Sodium Metaphosphate (Calgon).—Flaked, loose in metal drums. £103 ton.

Sodium Metasilicate.—£19 to £19 5s. per ton, d/d U.K. in ton lots.

Sodium Nitrate.—Chilean Industrial. 97-98 per cent, 6-ton lots, d/d station, £20 10s. per ton.

Sodium Nitrite.—£29 10s. per ton.

Sodium Percarbonate.—12½% available oxygen, £7 per cwt. in 1-cwt. drums.

Sodium Phosphate.—Di-sodium, £32 10s. per ton d/d for ton lots. Tri-sodium, £62 per ton d/d for ton lots.

Sodium Prussiate.—9d. to 9½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Silicofluoride.—Ex store, nominal.

Sodium Sulphate (Glauber Salt).—£8 per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. £6 per ton d/d station in bulk. MANCHESTER: £6 5s. per ton d/d station.

Sodium Sulphide. — Solid, 60/62%, spot. £23 per ton, d/d, in drums; broken, £23 15s. per ton, d/d, in casks.

Sodium Sulphite.—Anhydrous, £29 10s. per ton; pea crystals, £20 10s. per ton d/d station in kegs; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £14 12s. 6d. to £16 17s. 6d., according to fineness.

Sulphuric Acid.—168° Tw., £6 10s. to £7 10s. per ton; 140° Tw., arsenic free £5 2s. 6d. per ton; 140° Tw., arsenious, £4 15s. per ton. Quotations naked at sellers' works.

Tin Oxide.—1-cwt. lots d/d £25 10s.

Titanium Oxide.—Comm., ton lots, d/d, (56 lb. bags), £102 per ton.

Zinc Oxide.—Maximum prices per ton for 2-ton lots, d/d; white seal, £101 15s.; green seal, £100 15.; red seal, £99 5s.

Zinc Sulphate.—£34 per ton.

Rubber Chemicals

Antimony Sulphide.—Golden, 4s. to 5s. per lb. Crimson, 2s. 7½d. to 3s. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Best white bleached, £8 3s. 6d. per ton.

Cadmium Sulphide.—6s. to 6s. 6d. per lb.

Carbon Bisulphide.—£37 to £41 per ton, according to quality, in free returnable drums.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£56 to £59 per ton, according to quantity.

Chromium Oxide.—Green, 2s. per lb.

India-rubber Substitutes.—White, 10 5/16d. to 1s. 5¾d. per lb.; dark, 10½d. to 1s. per lb.

Lithopone.—30%, £36 15s. per ton.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£49 per ton.

Vermilion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Nitrogen Fertilisers

Ammonium Phosphate.—Not quoted—temporarily unobtainable.

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, in January, £10 6s. 6d., rising by 1s. 6d. per ton per month to March, 1949.

Calcium Cyanamide.—Nominal; supplies very scanty.

Compound Fertilisers.—Per ton d/d farmer's nearest station, I.C.I. No. 1 grade, where available, £10 14s. 6d. I.C.I. Special No. 1, £16 11s., rising by 2s. 6d. per ton per month to March, 1949.

"Nitro-Chalk."—£10 4s. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean for 6-ton lots d/d nearest station, £11 per ton.

Coal-Tar Products

Benzol.—Per gal. ex works: 90's, 2s. 6d.; pure, 2s. 8½d.; nitration grade, 2s. 10½d.

Carbolic Acid. — Crystals, 11½d per lb. Crude, 60's, 4s. 3d. MANCHESTER: Crystals, 10¾d. to 1s. 0½d. per lb., d/d crude, 4s. 3d., naked, at works.

Creosote.—Home trade, 6½d. to 9¾d. per gal., according to quality, f.o.r. maker's works. MANCHESTER: 6½d. to 9¾d. per gal.

Cresylic Acid.—Pale, 98%, 3s. 9d. per gal.; 99%, 4s. 2d.; 99.5/100%, 4s. 4d. American, duty free, 4s. 2d., naked at works. MANCHESTER: Pale, 99/100%, 4s. 4d. per gal.

Naphtha.—Solvent, 90/160°, 2s. 10d. per gal. for 1000-gal. lots; heavy, 90/190°, 2s. 4d. per gal. for 1000-gal. lots, d/d. Drums extra; higher prices for smaller lots. Controlled prices.

Naphthalene.—Crude, ton lots, in sellers' bags, £8 1s. to £12 13s. per ton according to m.p.; hot-pressed, £14 15s. to £15 14s. per ton, in bulk ex works; purified crystals, £28 to £43 5s. per ton. Controlled prices.

Pitch.—Medium, soft, home trade, 100s. per ton f.o.r. suppliers' works; export trade, £8 5s. to £9 5s. per ton f.o.b. suppliers' port. MANCHESTER: 100s. f.o.r.

Pyridine.—90/140°, 21s. per gal.; 90/160°, 19s. MANCHESTER: 17s. 6d. to 21s. per gal.

Toluol.—Pure, 3s. 2½d. per gal.; 90's, 2s. 4d. per gal. MANCHESTER: Pure, 3s. 2½d. per gal. naked.

Xylol.—For 1000-gal. lots, 3s. 3½d. to 3s. 6d. per gal., according to grade, d/d.

Wood Distillation Products

Calcium Acetate.—Brown, £15 per ton; grey, £22.

Methyl Acetone.—40/50%, £56 to £60 per ton.

Wood Creosote.—Unrefined, from 3s. 6d per gal., according to boiling range.

Wood Naphtha.—Miscible, 4s. 6d to 5s. 6d. per gal.; solvent, 5s. 6d. to 6s. 6d. per gal.

Wood Tar.—£6 to £10 per ton.

Intermediates and Dyes (Prices Nominal)

m-**Cresol** 98/100%.—Nominal.

o-**Cresol** 30/31° C.—Nominal.

p-**Cresol** 34/35° C.—Nominal.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb.; 66/68° C., 1s.

p-**Nitraniline.**—2s. 5d. per lb.

Nitrobenzene.—Spot, 5½d. per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyers' works.

Nitronaphthalene.—1s. 2d. per lb.; P.G. 1s. 0½d. per lb.

o-**Toluidine.**—1s. per lb., in 8/10-cwt. drums, drums extra.

p-**Toluidine.**—2s. 2d. per lb., in casks.

m-**Xylidine Acetate.**—4s. 5d. per lb., 100%.

Latest Oil Prices

LONDON.—February 23.—The prices of LINSEED, RAPESEED, COCONUT, PALM KERNEL, GROUNDNUT and WHALE OILS, as well as ACID OILS, are unchanged (THE CHEMICAL AGE, October 30, 1948). These prices continue for periods ending March in respect of crude oils, and March 26 for refined oils. ROSIN and TURPENTINE prices remain the same, according to grade.

Increased Production and Use of Natural Rubber

PRELIMINARY information on the rubber situation throughout the world last year, compared with figures for 1947, has been issued by the secretariat of the Rubber Study Group.

Total consumption of natural and synthetic rubber in 1948 totalled 1.895 million tons, an increase of 120,000 tons over the previous year.

In natural rubber there was considerable increase in production, output for 1948 in long tons being 1515, compared with 1255 in 1947. Malaya produced 698,000 long tons and Indonesia 430,000, 52,000 and 152,000 higher respectively than the previous year. Consumption in thousands of tons totalled 1407, the main users being U.S.A. (623), U.K. (194), Europe (365), and the rest of the world (225).

Synthetic rubber production showed a drop compared with 1947 with a total (in thousands of tons) of 533 for 1948 and 558 the previous year. Figures for individual countries were: U.S.A. 490, compared with 509; Canada 40 (42); Germany (British Zone) 3 (8). Stocks at the end of last year were 125, an increase of 48 over 1947.

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SITUATIONS VACANT

None of the vacancies in these columns relates to a man between the ages of 18 and 50 inclusive, or a woman between the ages of 18 and 40 inclusive, unless he or she is exempted from the provisions of the Control of Engagement Order, or the vacancy is for employment exempted from the provisions of that order.

AN expanding Middle East Oil Company urgently requires an Assistant Engineer to work initially in the London Office and be willing to accept transfer to the Persian Gulf after one year. Should possess B.Sc. Degee in Chemical or Mechanical Engineering. Will be required to assist in duties involving loading and bunkering facilities, oil gas distribution, and other oil control duties. Some experience of these duties essential. Experience in oil bunkers control with docks operating group of the Royal Engineers may be advantageous. Age 25–30. Salary starting £600-£700 per annum according to age and experience. Write, giving brief details, for application form, and quoting LO 133, to Box "P.Y." c/o J. W. VICKERS & CO., LTD., 7/8, Great Winchester Street, London, E.C.2.

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have a vacancy for an enterprising Technical Sales Representative. A practical knowledge of vegetable and synthetic tannins and auxiliary chemical products, together with their application, is a necessary qualification. Replies, stating age, personal details and full experience, to be addressed to :—

THE SECRETARY,
ROSE HILL TANNERY, BOLTON.
All applications will be treated in strict confidence.

SITUATIONS VACANT

ASSISTANT Works Engineer required for construction and maintenance of chemical works, West Riding, Yorkshire. Applicant should be 25 to 35 years of age. Should have sound theoretical training and practical experience in Mechanical Engineering and chemical works plant. Applicant should state age, full details of training, experience and salary to Works Manager, Box No. 2772, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

CHEMIST/Paint. Degree standard or equivalent to take charge and develop laboratory section connected with control of works paint and stoving processes. A good knowledge of modern organic finishes, including plastic technology, is essential. Applicants should have had good industrial experience. State age, full details, qualifications and experience. Box No. 2774, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

ELECTRO Metallurgist wanted for small London research and experimental laboratory. Good electro deposition and chemical experience including analysis essential. Permanent progressive situation. Handwritten applications with copy references and details previous experience, salary required. Box No. 2771, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

FIRST-CLASS Engineer required for construction and maintenance in a large chemical plant in the Home Counties. Applicants should be capable of commanding a salary of not less than £1,000 p.a. Candidates should be between 30 and 40 years of age, and should have either a Degree in Engineering, or have passed examinations recognised by the Institution of Civil or Mechanical Engineers, as granting exception from Sections A and B of their examination for Associate Membership. Should have sound practical experience in mechanical engineering, including steam raising and power generation. Experience of chemical works practice an advantage. Permanent position carrying superannuation scheme. Candidate should state age, full details of training and experience, also salary required, to Box No. 2773, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

LABORATORY TECHNICIAN, aged 25-30, required in Technical Sales Department of Scientific Apparatus Suppliers, London. Salary, £300/£350 p.a., 5-day week, superannuation scheme. Good prospects for keen man anxious to apply practical experience to salesmanship. Write, stating experience and qualifications, to Box No. 2775, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

THE British Oxygen Company, Ltd., require urgently for their headquarters staff, highly trained Draughtsmen, aged 25-40. Men who have obtained their Higher National Certificate in Mechanical Engineering and who have had practical experience in the preparation of chemical works lay-out drawings and site drawings (knowledge advantage), should apply in writing to **Department M.12,** at **Grosvenor House, Park Lane, London, W.1.** This advertisement is published by permission of the Ministry of Labour and National Service, under the Control of Engagement Order, 1947.

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One—Simons Patent **MULTI-TUBULAR DRIER,** size 3C, capacity, 4½ tons per hour with moisture reduction of 10 per cent, using steam at 100 lb. p.s.i. Trough, 12 ft. long by 6 ft. wide by approx. 6 ft. deep. Internal reel of solid drawn steel tubes rotates by ratio of 1 : 4.

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One—Werner Pfleiderer type **TROUGH MIXER,** approx. 2 ft. 10 in. long by 2 ft. 3 in. wide by 2 ft. deep, twin "Z" blade agitators. Drive by 28-in. diam. by 4-in. face fast and loose pulleys, hand lever tilting.

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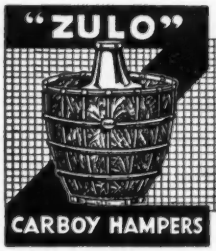

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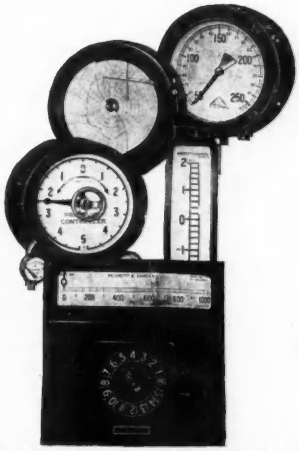

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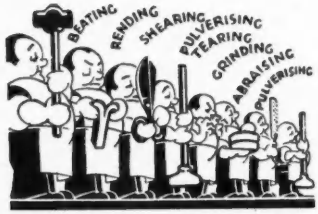

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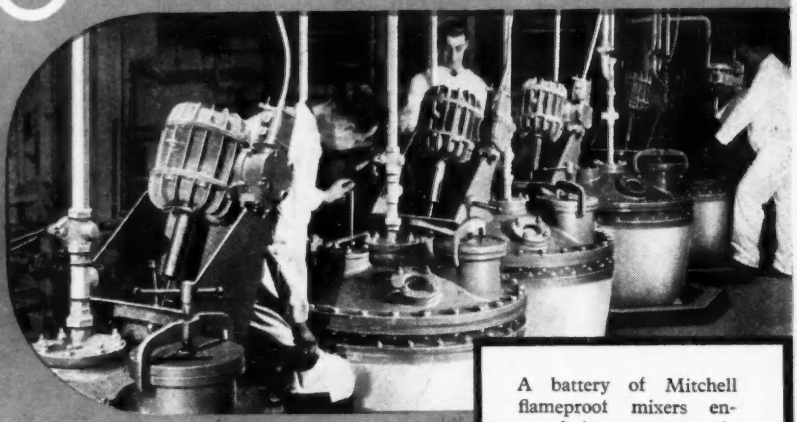

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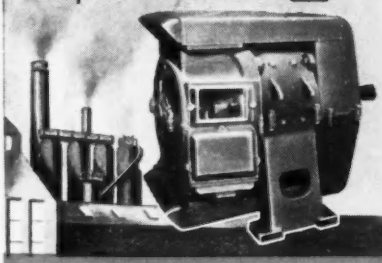

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